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ABSTRACT

The Texas Teacher Internship Program (TTIP) is a competitive program for science, technology and mathematics teachers who serve as summer interns at industry and university sites in order to experience real world applications of the subjects they teach. This document contains curriculum implementation plans developed by the teachers to illustrate how they would translate the summer experience into the subsequent year's classroom curricula. Topics covered in the curriculum plans include: industrial technology; information super highway; medical science; environmental resources; computer literacy; biology; DNA; algebra; data collection and analysis; integrating computers with business and science; mathematics; water pollution and analysis; photosynthesis; cellular respiration; endangered species; earth science; career opportunities; communication skills; critical thinking skills; bacteriology; physics; scientific method and research equipment; organic synthesis and gas chromatography; and cooperative learning. Appendices contain intern information list, teacher intern pre-questionnaire, teacner evaluations, mentor/coordinator pre-questionnaire, mentor program evaluation and orientation session evaluation. (JRH)

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ED 387 317

TTIP

Texas Teacher Internship Program

Texas A&M University

Brian T. Walenta, Editor

1994 CURRICULUM IMPLEMENTATION PLANS

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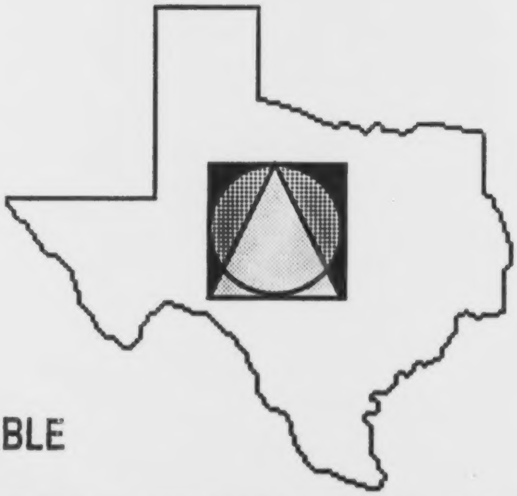

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Texas Alliance For Science, Technology & Mathematics Education

About the Alliance

The Texas Alliance for Science, Technology and Mathematics Education is a statewide, nonprofit organization whose membership includes representatives from K-12 schools, colleges and universities, businesses and industry, professional and civic organizations, and government agencies. By fostering partnerships between schools and the private sector, the Texas Alliance works to:

- improve student literacy and competency in science, mathematics and technology education; and
- assist teachers in developing curricula with emphasis on "real world" applications and problem-solving skills.

For membership and educational program information, contact:

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The Texas Teacher Internship Program is a project of the Texas Alliance for Science, Technology and Mathematics Education, under the direction of Dr. Robert K. James, EDCI, College of Education, Texas A&M University, College Station, TX 77843-4232.

Funding for the project is provided by the participating industries. Publication of the curriculum plans for 1994 was provided by Ranger Insurance Co., Houston, TX.

TTIP Program Mission

In 1989, the Texas Alliance for Science, Technology and Mathematics Education began placing teachers at industry sites as part of its now-successful program, the Texas Teacher Internship Program (TTIP—formerly Teacher-In-Industry). In the six years of the program, the numbers of both teacher participants and internship sponsors have increased steadily. Since its inception, over 120 teachers have interned at 42 company, university and government agency sites. With each teacher affecting an average of 150 students per year, over 52,400 Texas students have been directly impacted by TTIP to date.

TTIP is a competitive program for science, technology and mathematics teachers who serve as summer interns at industry and university sites in order to experience "real world" applications of the subjects they teach. Teacher interns are mentored by a scientist or engineer, and work on a project(s) for an 8 to 10 week internship period.

The objectives of the program are to:

- Provide teachers with relevant, timely information about science, technology and mathematics applications so they can better prepare students for the future.
- Establish interactive partnerships between industry and teachers—sharing resources and curriculum improvements, and strengthening state and community networks throughout the educational system.
- Increase teachers' awareness of industry expectations and career opportunities to better inform and motivate students regarding careers in science, technology, and mathematics.

In 1994, a total of 25 teachers interned at twelve sites. Each teacher was required to develop a curriculum implementation plan (CIP) which was to illustrate how they would translate the summer experience into the subsequent year's classroom curricula. The Alliance staff provided teachers with suggestions for developing the CIPs during site visits.

We are pleased with the success of the 1994 program and hope that you find the CIPs helpful in planning new activities for your students.

For more information on the Texas Teacher Internship Program, please write or call:

Brian T. Walenta, TTIP Coordinator
or
Robert K. James, Director
c/o Texas Alliance
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Texas A&M University
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Acknowledgements

The Texas Alliance for Science, Technology and Mathematics Education would like to thank the program's supporters for providing the opportunity for teachers to experience "real-world" applications of their teaching fields. Many thanks to the industry coordinators and mentors involved with the 1994 Texas Teacher Internship Program.

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Elfido Coss

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Cynthia Bandemer

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Patricia Loman
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Liz Troub - Texas Parks & Wildlife/ Star Enterprises/ HL&P 178

Ann Miller - Texas Parks & Wildlife 242

Frances Beeson - University of Texas Medical Branch at Galveston 266

Otis Carrell - University of Texas Medical Branch at Galveston 292

Barry Gray - University of Texas Medical Branch at Galveston 296

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Johnetta Session - University of Texas Medical Branch at Galveston 342

Donald Van Alstyne - University of Texas Medical Branch at Galveston 364

Laura Wolfe - University of Texas Medical Branch at Galveston 382

APPENDICES

Intern Information List

1994 Evaluation Information

TTIP

CURRICULUM IMPLEMENTATION PLAN

Abstract

NAME: John Ellis

INTERNSHIP: Advanced Micro Devices, Austin Texas

SCHOOL: Del Valle High School, Del Valle

PRIMARY SUBJECT: Industrial Technology - Production

ACTIVITIES:

- Ice breaker with the whole class
- Divide class into groups
- Manufacturing exercise
- Quality control exercise
- Evaluations as a group
- Field trips
- Guest speakers

SUMMARY: In the semiconductor manufacturing industry, working in groups is part of the job. The objective of the activity is to simulate a manufacturing facility and have students work in groups to produce as many products as possible in a specified amount of time. After the groups have had time to work together; introduce the quality control exercise. The objective of this exercise is to produce as many products as possible with as little defects as possible. Both of these exercises cover two very important goals of industry; one being teamwork and the other is producing a quality product which increases profits.

CURRICULUM IMPLEMENTATION PLAN

OBJECTIVES:

1. Students will be able to establish a foundation for structured teamwork.
2. Students will be able to use reading and writing to develop their goals as a team.
3. Students will learn how to communicate effectively.
4. students will learn responsibility and leadership skills.

SETTING UP THE ACTIVITY

To introduce this activity to the class, start out with the ice breakers provided. Make a transparency of the "common terms and phrases" sheet. have the students try and figure out the meaning of the pictures. This activity will increase the students self-esteem as they figure out the answers, therefore improving their motivation.

Explain to the class that they will be working in groups to manufacture a product called a truss. The product specification sheet will be passed out when the groups are divided. Each team will need to write down their goals that they want to accomplish as a group. Each team member will be assigned a job title and salary. The instructor may act as a manager, assigning jobs, overseeing production, and setting the production goal. The objective of each group is to produce as many trusses as possible within the allotted time. They are to learn their jobs and write down their group goals. Pass out the product specification sheet, scissors, tape, prototype, and 3X5 cards.

As the students start working in their groups, they should begin working out their processes and assigning jobs (folder, cutter, tape, inspection, etc.). Have the first run last five minutes. The procedure maybe repeated until the group is able to reach their production goal. You will be able to see improvements with each production run, and the group will become more united as they learn how to work with each other.

After several runs increase the number of trusses produced without defects. When better quality is demanded, the group will start to develop better ways to produce the trusses.

As a manager you will want to keep a tally of the number of trusses produced, the number of trusses that have defects, the number of trusses that you inspected that had defects. Record the number for each run on the chalkboard.

Before the groups disband, have the group answer the following questions:

1. How well was the group able to work together ?
2. How well did your group perform?
3. How well did you perform for the group?

Explain to the group how critical it is in industry to produce quality work. Review with the class the number of trusses you found defective. This would represent the number of defective products the customer would buy. Resulting in the number of dissatisfied customers your company would have to make happy; not to mention the number of people they are going to tell. The goal of every business should be zero defects and 100% customer satisfaction to insure maximum profits.

To evaluate the project, have each student write a one page essay on how to produce trusses with zero defects.

Job Description and Salary

Folder - Fold card stock according to specs.
20k/yr

Paper cutter - cuts card stock according to specs.
20k/yr

Tape/Assembler - cuts tape and assembles trusses
25k/yr

Inspection/Team leader - Inspects each truss according to specs
30k/yr

SUPPLIES

Give each team the following supplies:

A. A stack fo 3x5 cards

B. Scissors

C. 1 roll of masking tape

D. Prototype

E. Ruler

F. Pencil

GOAL SHEET

1. How many Trusses will your group produce correctly?

2. How many Trusses can your group produce in five minutes?

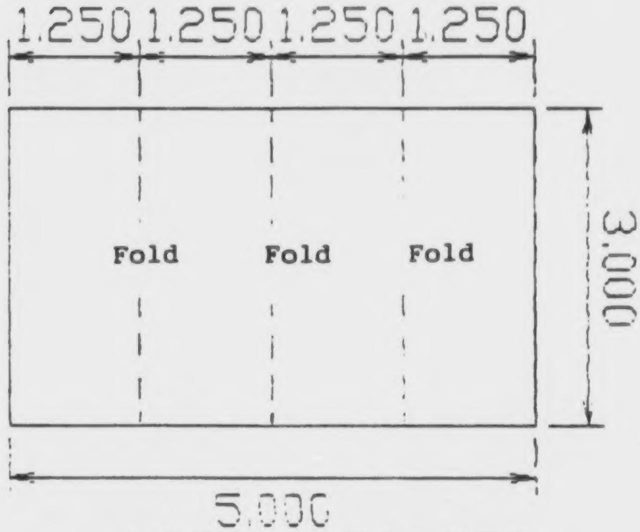
3. How can your group improve production?

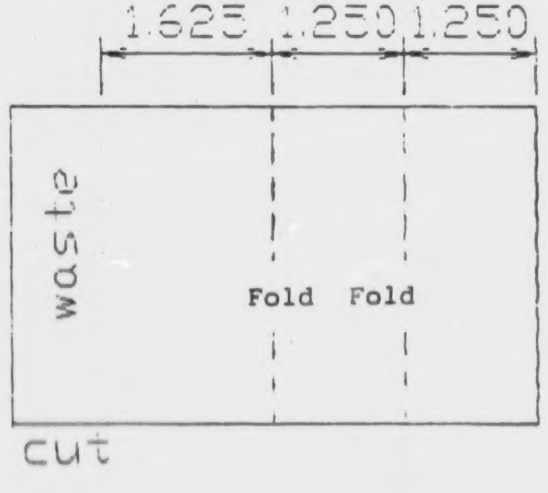
PRODUCTION PERFORMANCE SHEET

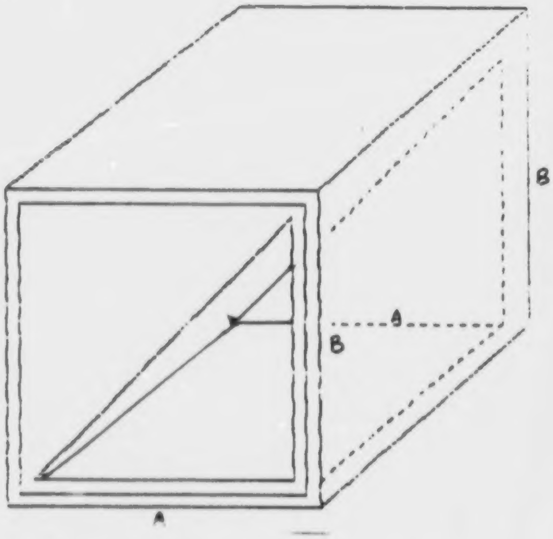
Group#	#of Products Produced	# of Defects found in groups	# of Defects Manager found

Product Specification Sheet
Pattern used to produce phototypes:

This should produce a square tube 3x1.25x1.25
use 1 piece of tape 3in. long x.75"
wide to seal the tube


1.250
1.250
1.250
1.250
Fold
Fold
Fold
3.000
5.000


1.625
1.250
1.250
waste
Fold
Fold
cut



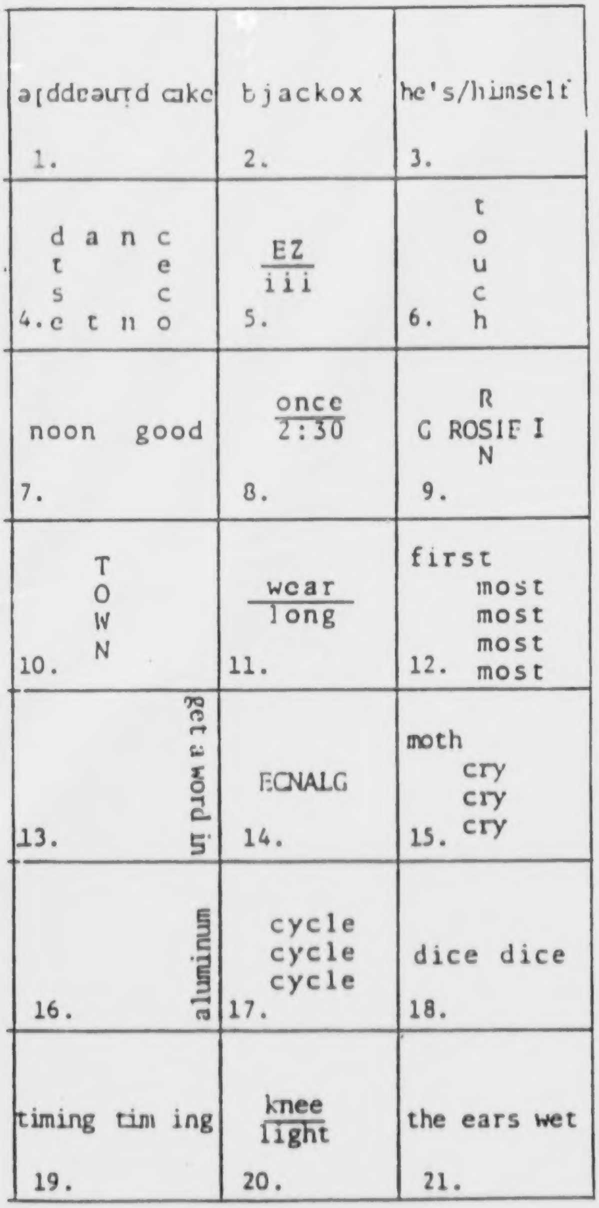
This should produce a triangle tube
use 1 piece of tape 3in. long x.75"
wide to seal the tube

Insert the triangle tube inside
the square tube to produce a truss.
Secure the triangle tube inside the
square tube using two pieces of tape
.75"x.5" on each end, and attaching to
the square tube walls a & b

MIND BENDERS

"COMMON TERMS AND PHRASES"

ANSWERS:


1. pineapple cake
2. bjackox
3. he's/himself
4. d a n c e c o n t e s t
5. EZ / iii
6. t o u c h
7. noon good
8. once / 2:30
9. R G ROSIE I N
10. T O W N
11. wear / long
12. first most most most most
13. get a word in
14. ECNALG
15. moth cry cry cry
16. aluminum
17. cycle cycle cycle
18. dice dice
19. timing tim ing
20. knee / light
21. the ears wet

1. Upside down pineapple cake.
2. Jack in the box
3. He's beside himself.

4. Square dance contest.
5. Easy on the eyes.
6. Touchdown.

7. Good afternoon.
8. Once upon a time.
9. Ring around the rosie.

10. Downtown.
11. Long underwear.
12. First and fourmost.

13. Can't get a word in edge wise.
14. Backwards glance.
15. Moth balls.

16. Aluminum siding.
17. Tricycle.
18. Paradise.

19. Split second timing.
20. Neon light.
21. Wet behind the ears.

RESOURCES

Kathrin Brewer
Operations Facilitator
AWFD systems Integration
Advanced Micro Devices
5204 E. Ben White Blvd.
Mail stop 568
Austin Texas 78741
512-602-5153

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5204 E. Ben White Blvd
Austin Texas 78741
512-602-5153

Greene, Brad. (1991) Self Esteem and the Quality School. The Quality School Consortium, Simi Valley, CA .

TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME: Jim Roe

INTERNSHIP: Advanced Micro Devices
Austin, Texas

SCHOOL: Del Valle High School
Del Valle, Texas

PRIMARY SUBJECT: Composite Science

ACTIVITIES:

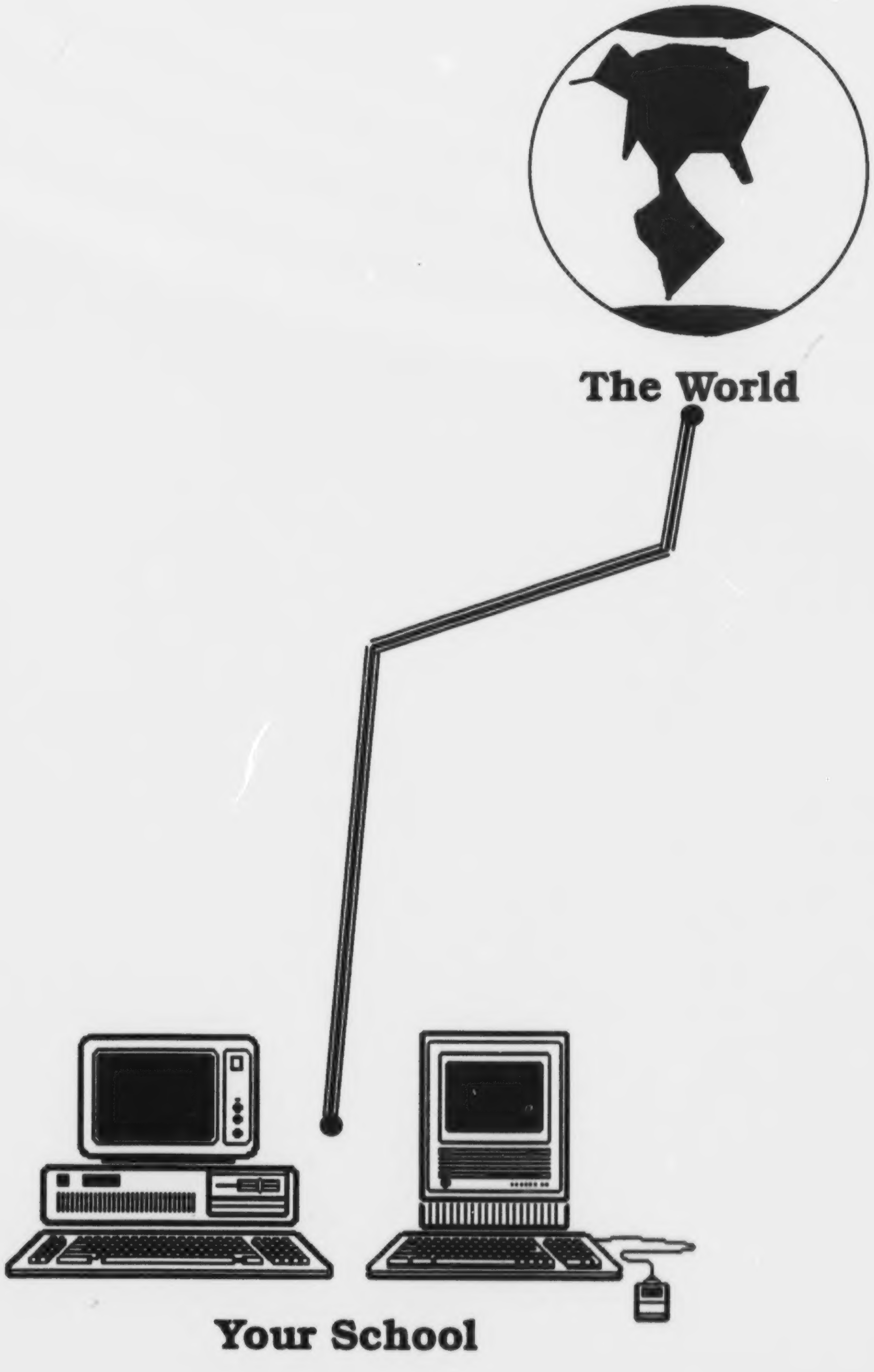
- Accessing the Informational Super Highway

SUMMARY: We hear more and more about the Information Super Highway. Public schools need to have access to this information right now and be at the forefront of this exciting research opportunity. SHort of access, the teacher or librarian can set up an informational net of resources locally that students and staff can have instant access.

RESOURCES: Jim Roe
Del Valle High School
2409 Shapard
Del Valle, Texas 78617
512-389-7381

Mark Harris
Advanced Micro Devices, Test 17
5204 East Ben White Blvd.
Austin, Texas 78741
512-602-4677

The Informational Super Highway


The World
Your School

Accessing the Information Super Highway

Teacher: Jim Roe
Mentor: Mark Harris

OBJECTIVES:

1. Allow staff and students access to the world wide network of available research papers and files much needed for research in today's world where information is gathering at a quicker pace than anyone can keep up.

2. Develop instant access to this Information Super Highway.

3. If access is not immediately available, develop an "in house" Information Super Highway.

REQUIREMENTS:

1. Hardware Required:
   a. IBM or Macintosh computer(s) with a minimum of 2 megs of memory. Four or eight megs is even better.
   b. A 9600 or 14.4 modem for connection to the Internet and phone line.
   c. A SVGA monitor is recommended but not required. A b/w VGA monitor is sufficient.

   Software Required:
   a. Windows for DOS or the MAC envoironment
   b. Mosaic or Cello - DOS versions are available from either of the people listed above (Mosaic requires a program called Win32s available from the above.)
   c. A Winsock - Trumpet is a shareware winsock and is available from the above people.

   Vendors Required
   a. To access the Internet, a SLIP connection is required. There currently is a SLIP provider in the Austin area and more are coming on line across the state. The fees are around $120 per year. However, if there were sufficient interest from school districts, TEANet would probably provide this service if it does not already.

INSTALLATION:

Installation of the software is straight forward for anynoe with an average knowledge of the computing platform available. Follow the instructions that come with the software and you can be running in a matter of minutes (a couple of hours). Use of the software is straight forward and requires no special skill other than being able to "point and click" with a mouse.

WHAT IT DOES:

Both Mosaic and Cello are HyperText Transfer Protocols (HTTP) and HyperText readers. They incorporate visuals and sound if such is available in the file being accessed and your computer is equiped with a visual wiewer and sound card.

With the computer set up correctly, a user can turn on the computer and the HTTP software will come up on a "home page." This home page can be a local index of files and the user can then "point and click" to retrieve the desired document.

Accessing the Internet requires establishing a SLIP connection and the software explains how to set up a connection.

Once connected, the user returns to the HTTP program and can "point and click" on a topic of particular interest. The software will then establish a connection to the site - NO MATTER WHERE IT IS IN THE WORLD! The connection is almost instantaneous and often is transparent.

Once connected, the user will see the "home page," or index of the host system. From there, the user can "point and click" through several levels of indexes and quickly pull up a research paper, document, or other information relating to a desired topic. Host systems are topic specific and are often state or national repositories of information on a single subject.

The user can read the documant at leisure and can even save parts of the document or all of it, thus making the old note cards obsolete. Often, the document will refer to other sources and will be linked using the hypertext format where all the user has to do is, again, "point and click." The linked document may be on the host, or another host in another part of the world.

Research has never been easier and has never been so current. Also, binary files (non-text) are available using the same software. The world has just opened up as the different types of information and files available are beyond imagination. These come from around the world and are free for the taking by just using the mouse.

ALTERNATIVE APPLICATIONS:

If a SLIP source is not immediately available, then a local application can be developed. Using text files already avaliable or entered into the computer. A program called Hyperedit can be used to convert these documents or even create documents that can be indexed and accessed by Cello or Mosaic. Various applications can be immediately seen. A classroom teacher can hyperlink old tests and study sheets for students needing more help, review, or even make up work. Local school libraries can hypertext many documents and have them available for instant access for the user.

Once set up, when a SLIP access becomes available, conversion to the entire world of informaion is available.

CONCLUSION:

Sounds too easy to be true? It is not. The software is shareware and being improved constantly. While the documentation that comes with the software is often skimpy, an average computer user can have this running in a matter of two or three hours. If Cello and Trumpet are used, the documentation is quite good and installation is very simple. Using to software is so simple, elementary students can learn to use it quickly.

The Information Super Highway is now available at low cost and ease of use.

TTIP
CURRICULUM IMPLEMENTATION PLAN
ABSTRACT

NAME: Jana Bassinger-Deloach

INTERNSHIP: Harris County Medical Center

SCHOOL: Park View Intermediate, Pasadena

PRIMARY SUBJECT: The Houston Museum of Medical Science

ACTIVITIES:
Develop survey for Harris County students
Administer survey
Tabulate data
Compile data in following report
Organize and facilitate student and teacher focus groups
Compile focus group meetings into reports
Develop a volunteer manuel pertaining to human body digestive system
Research and compose new curriculum for health and human body

MUSEUM OF MEDICAL SCIENCE
1133 M.D. ANDERSON BLVD., SUITE 400
HOUSTON, TX 77030-2896

MUSEUM OF MEDICAL SCIENCE STUDENT SURVEY

PRELIMINARY REPORT

PURPOSE: To find information pertaining to student interest which will aid in the development of field trip activities.

METHOD: Preliminary sampling was conducted with 431 students surveyed from various schools in Harris County (Aldine, Pasadena, and Cypress-Fairbanks schools participated) Some students were enrolled in summer school programs, while others were attending year round school. A wider sampling of other Harris County schools is currently underway.

1. Students were asked to identify two of their favorite subjects in school. Overall, students reported that Physical Education was their favorite subject with 185/431 positive responses toward this course. Science was reportedly the second most favored course with 170/431 positive responses documented. Art came in third with a total number of 157/431 positive responses. Math had a total number of 125/431 positive responses making it fourth in the ranking.

2. Students were then asked to identify their least favorite subject. By far, Math was considered the subject favored least by the children. 113/431 students chose Math as their least favorite subject. Language Arts and Social Studies followed with respective negative reactions of 67/431 and 55/431.

3. A total of 414/431 students reported that they enjoy learning. This overwhelming majority dispels the assumption of many teachers that students do not want to learn. The information was needed to verify that children still have the desire to learn, even though it is not always in orthodox methods or topics.

4. The second set of children surveyed were asked if they had ever visited a museum. 262/287 stated they had visited an informal learning center.

6. Students were asked if they had ever visited a museum with someone other than with a school group. 358/431 stated that they had, which conflicts with existing research information. There is no feasible way to validate if the students have actually visited a museum with someone other than a school group.

7. Students were asked to select, from a list of possible learning methods, their preferences for how to learn about the heart. Listed below are the top 6 methods and the number of positive responses each received. Students were encouraged to list others if one was not available that they enjoyed. Many listed going on field trips as the "other".

OVERALL TOTAL POSITIVE RESPONSES (GRADES 3-8) -- N=431

Demonstrations/Using Specimens	350
Experimenting In Small Groups	344
Watching Films	334
Making Models	321
Small Group Act./Discussions	239
Role Playing	215

GRADES 3 & 4 POSITIVE RESPONSES -- N=166

Making Models	146
Watching Films	142
Demonstrations/Using Specimens	136
Experimenting in Small Groups	135
Role Playing	88
Small Group Act./Discussion	82

GRADES 5 & 6 POSITIVE RESPONSES -- N=181

Demonstrations/Using Specimens	152
Experimenting in Small Groups	146
Making Models	130
Watching Films	123
Small Group Act./Discussions	111
Role Playing	100

GRADES 7 & 8 POSITIVE RESPONSES -- N=84

Watching films	69
Experimenting in small groups	63
Demonstrations/Using specimens	62
Small group activities/discussions	46
Making models	45
Role Playing	27

***THE FOLLOWING GRAPHS WILL SHOW THE TOP 5 RESPONSES**

8. Students were asked, in an open-ended fashion, to name three things they would like to learn about the human body. The most common responses are listed below.

OVERALL TOTAL RESPONSES (GRADES 3 - 8) -- N=431

Heart/Blood	165
Brain/Nerves	162
Bones/Muscles	78
Sex/Adolescence	65
Lungs	48
How the Body Works	37
Stomach/Intestines	35

GRADES 3 & 4 RESPONSES -- N=166

Heart/Blood	70
Brain/Nerves	59
Bones/Muscles	38
Lungs	14
Stomach/Intestines	14
How the Body Works	8
Sex/Adolescence	3

GRADES 5 & 6 RESPONSES -- N=181

Brain/Nerves	81
Heart/Blood	71
Sex/Adolescence	42
Bones/Muscles	29
How the Body Works	24
Lungs	24
Stomach/Intestines	16

GRADES 7 & 8 RESPONSES -- N=84

Heart/Blood	24
Brain/Nerves	22
Sex/Adolescence	20
Bones/Muscles	11
Lungs	10
How the Body Works	5
Stomach/Intestines	5

***THE FOLLOWING GRAPHS WILL SHOW THE TOP 5 RESPONSES**

9. Students were asked to identify which topics or issues they would like to learn more about from a list provided in the questionnaire. They were then asked to rank their positive responses. Many of the students had difficulty ranking their responses, so only the number of positive responses is recorded here.

OVERALL TOTAL POSITIVE RESPONSES (GRADES 3 - 8) -- N=431

HIV/AIDS Education	317
Drug and Alcohol Awareness	314
How the Brain Works	311
Kids and Stress	298
Family Living/Sex Ed	295
Disease Prevention	287
Environment/Health	257
Effects of Smoking	257

GRADES 3 & 4 POSITIVE RESPONSES -- N=166

Drug and Alcohol Awareness	145
How the Brain Works	144
HIV/AIDS Education	134
Environment/Health	131
Effects of Smoking	129
Kids and Stress	125
Disease Prevention	122
Family Living/Sex Ed	108

GRADES 5 & 6 POSITIVE RESPONSES -- N=181

HIV/AIDS Education	134
Disease Prevention	131
How the Brain Works	130
Family Living/Sex Education	126
Kids and Stress	119
Drug and Alcohol Awareness	116
Environment/Health	98
Effects of Smoking	92

TOPICS (continued)

GRADES 7 & 8 POSITIVE RESPONSES -- N=84

Family Living/Sex Education	61
Kids and Stress	54
Drug and Alcohol Awareness	53
HIV/AIDS Education	49
How the Brain Works	37
Effects of Smoking	36
Disease Prevention	34
Environment/Health	28

***THE FOLLOWING GRAPHS WILL SHOW THE TOP 5 RESPONSES**

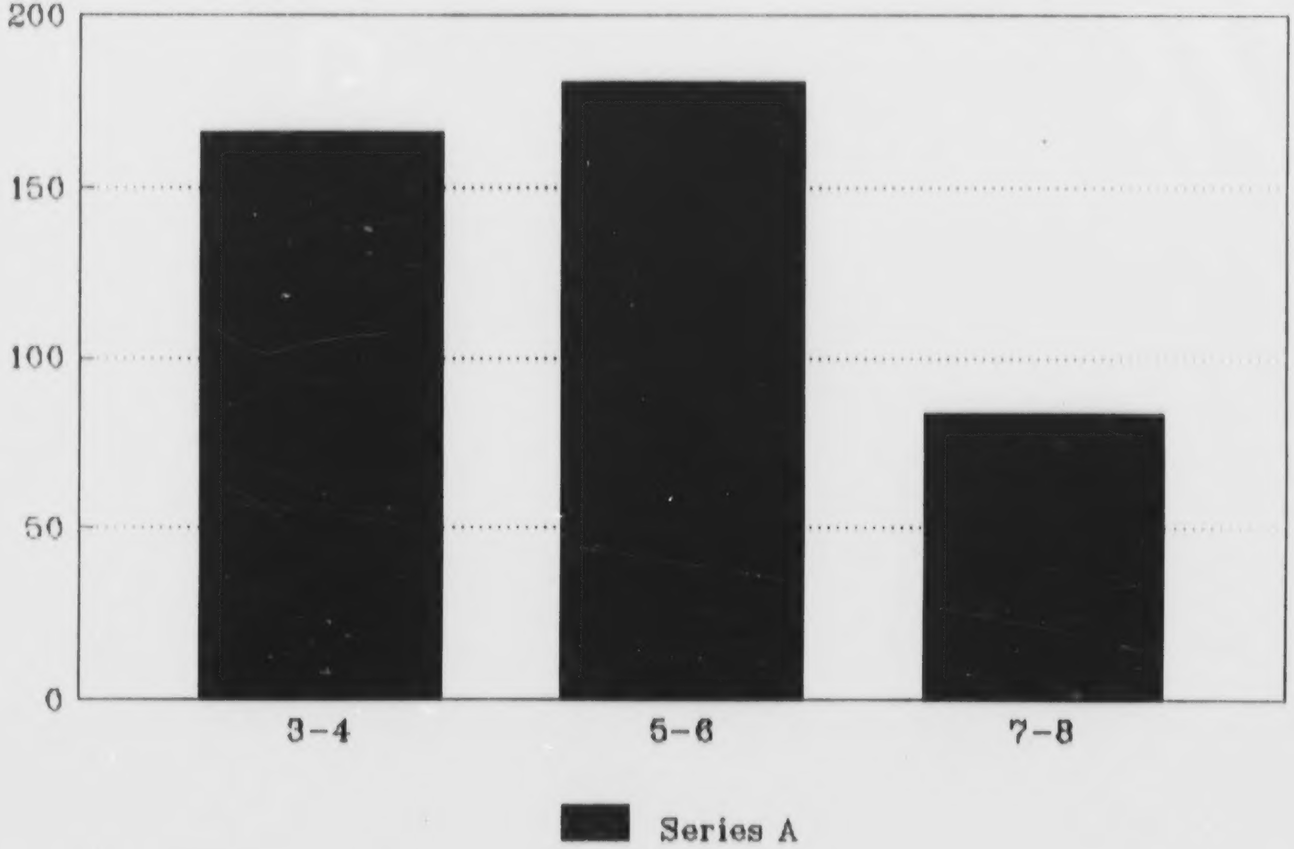
10. The initial surveys showed that "Kids and Stress" was a topic in which students had great interest. To define what, exactly, children thought of as stress, the second set of students surveyed were asked to list things that caused them stress. Because of writing abilities, the younger students (3rd & 4th graders) did not receive this question in their surveys. Thus far, only 96 students were asked this question.

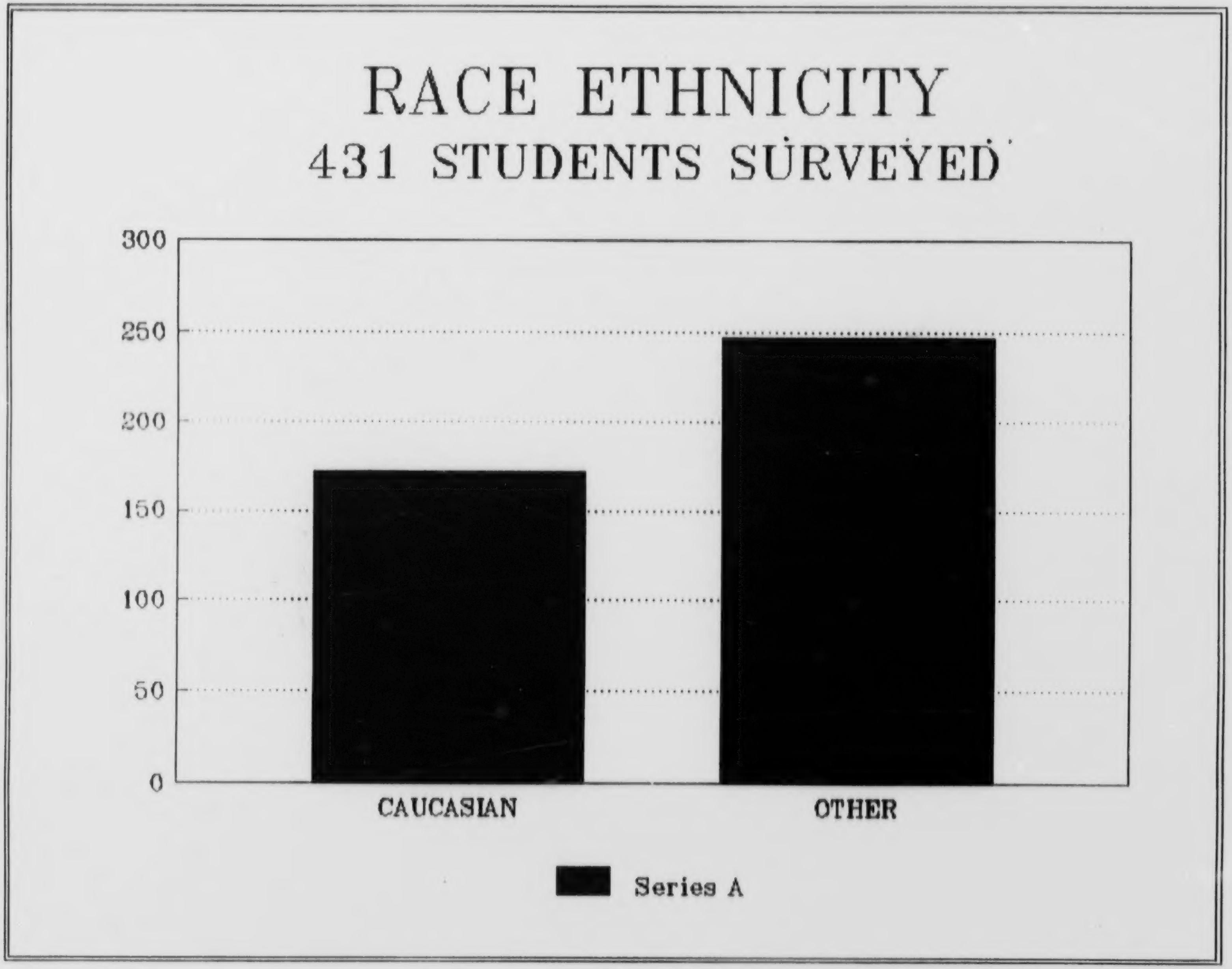
-- 66 students stated that homework and school concerns are a major cause of stress.
-- 26 students recorded that problems at home cause them stress.
-- Gang violence and peer pressure were mentioned by 30 and 29 students, respectively, as a cause of stress and worry.
-- A few other responses included are listed below:

* Suicide
* Death of a parent
* Being raped
* Family getting shot and killed
* Being kidnapped

GRADE CLUSTER TOTALS

431 STUDENTS SURVEYED

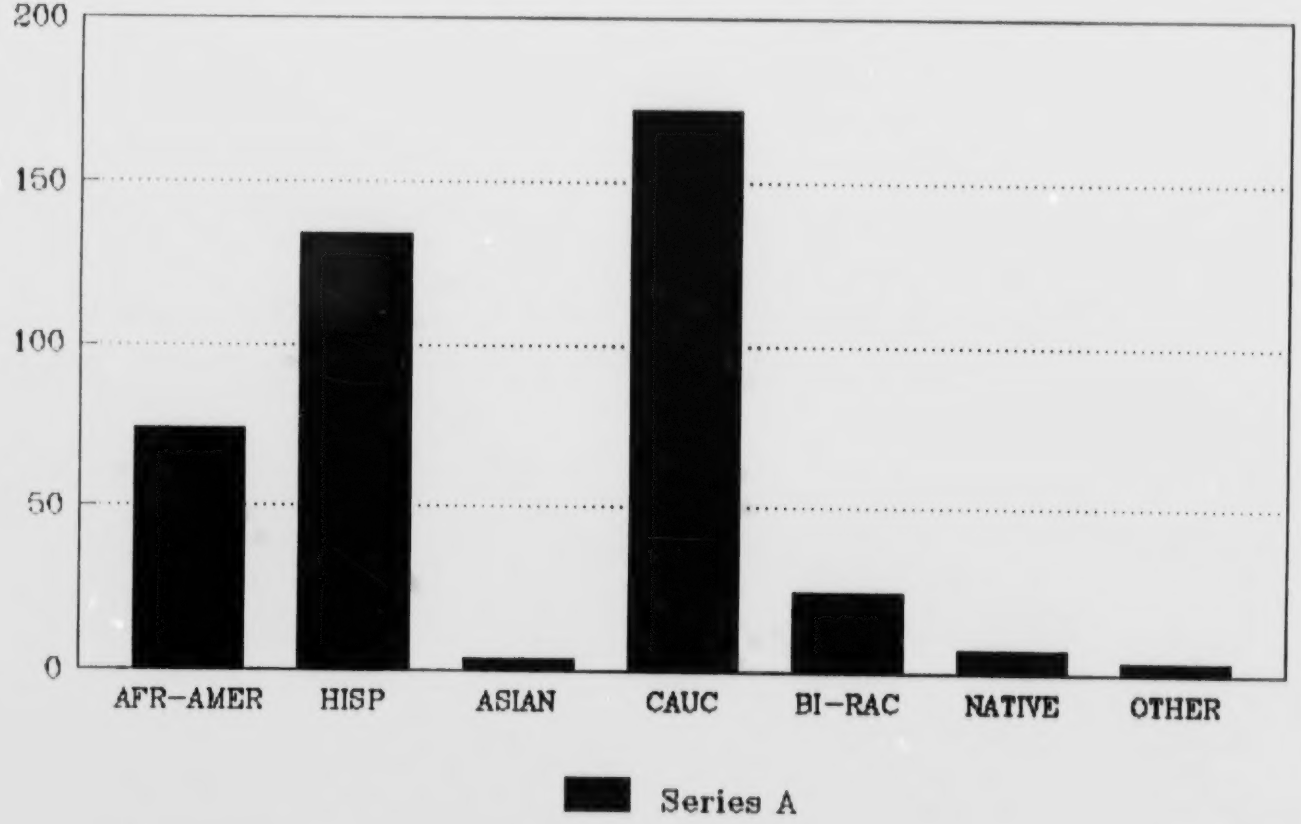




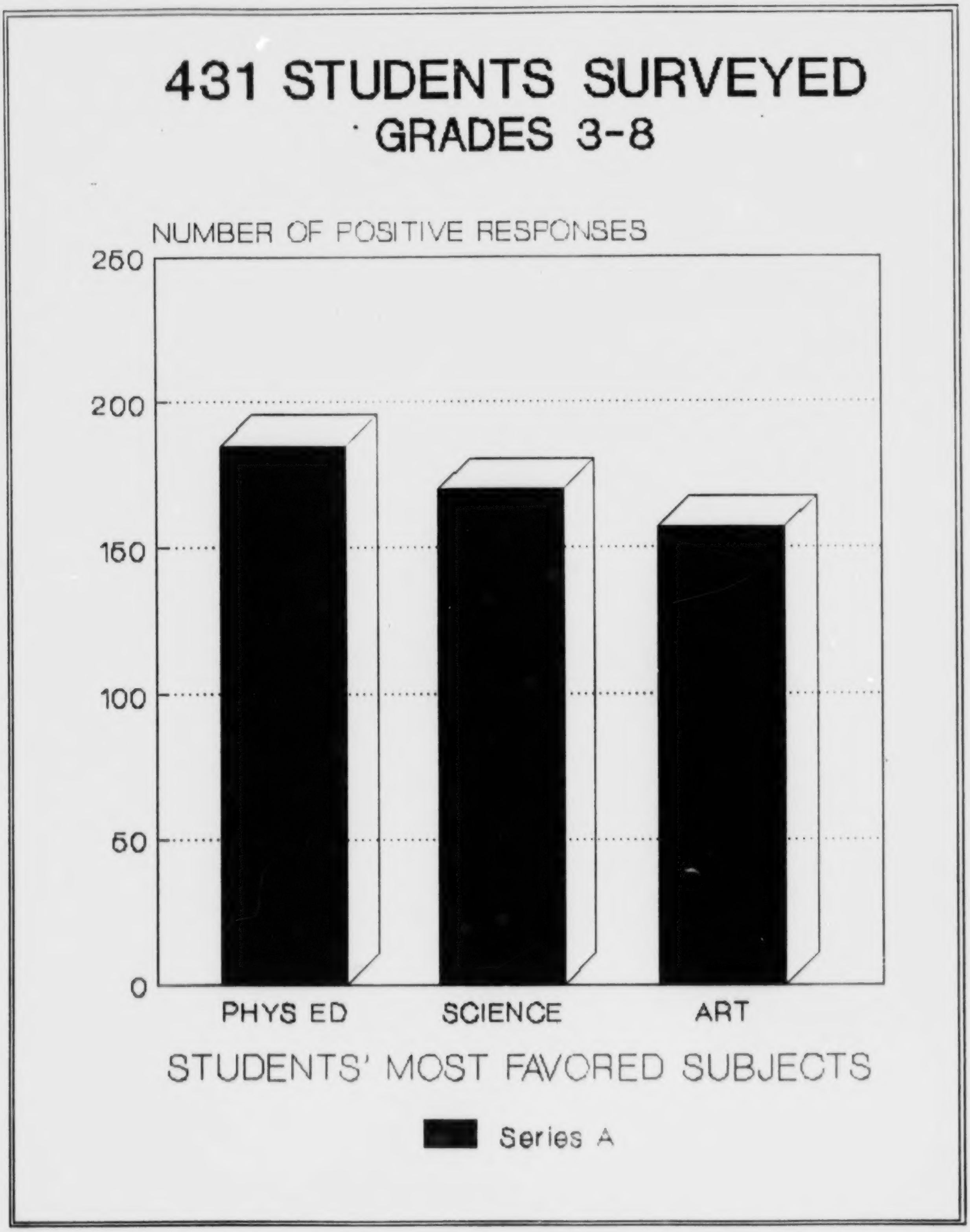
RACE ETHNICITY
431 STUDENTS SURVEYED

RACE/ETHNICITY

431 STUDENTS SURVEYED

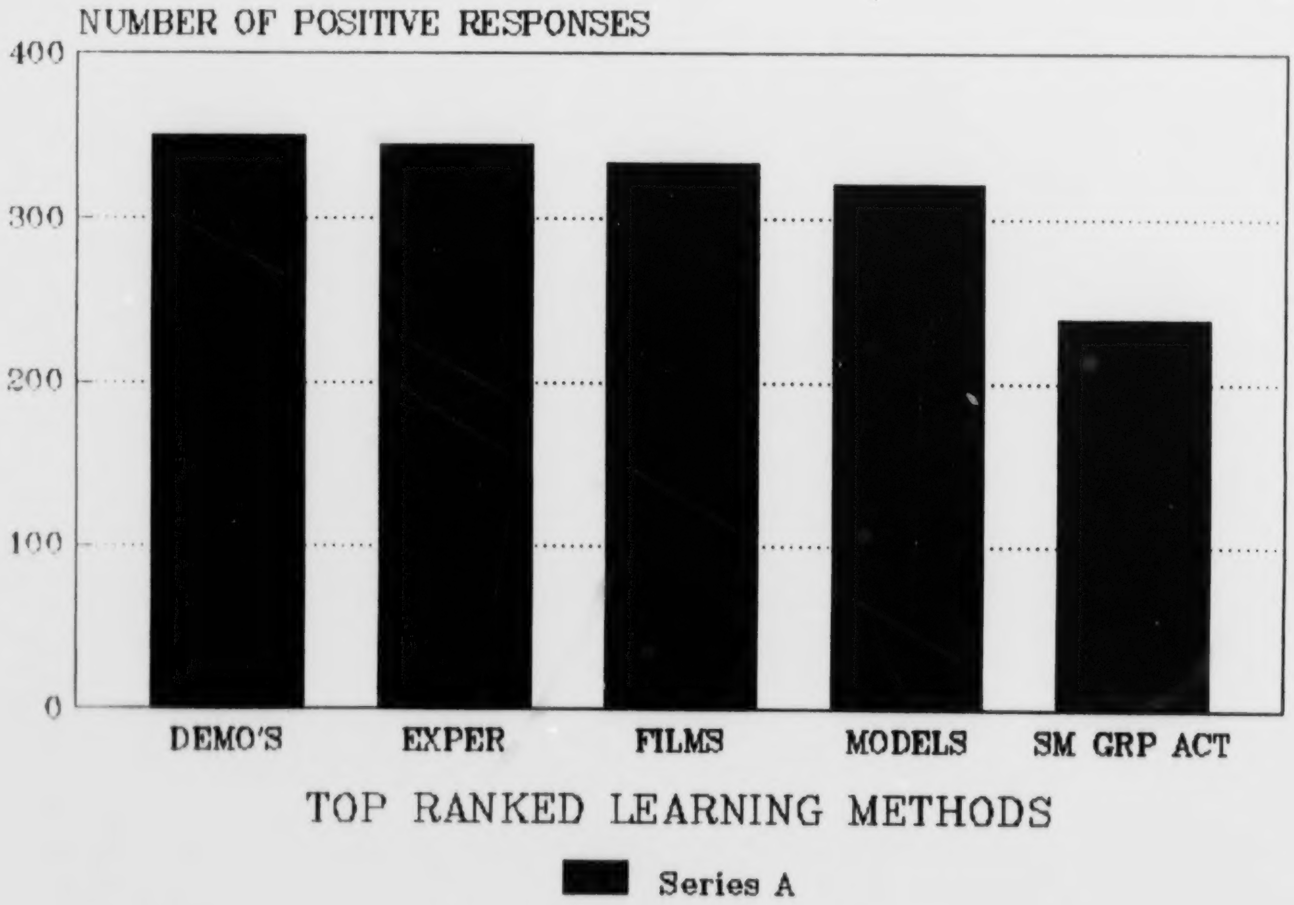


NUMBER OF EACH RACE/ETHNIC GROUP


431 STUDENTS SURVEYED
GRADES 3-8
NUMBER OF POSITIVE RESPONSES
250
200
150
100
50
0
PHYS ED
SCIENCE
ART
STUDENTS' MOST FAVORED SUBJECTS
Series A

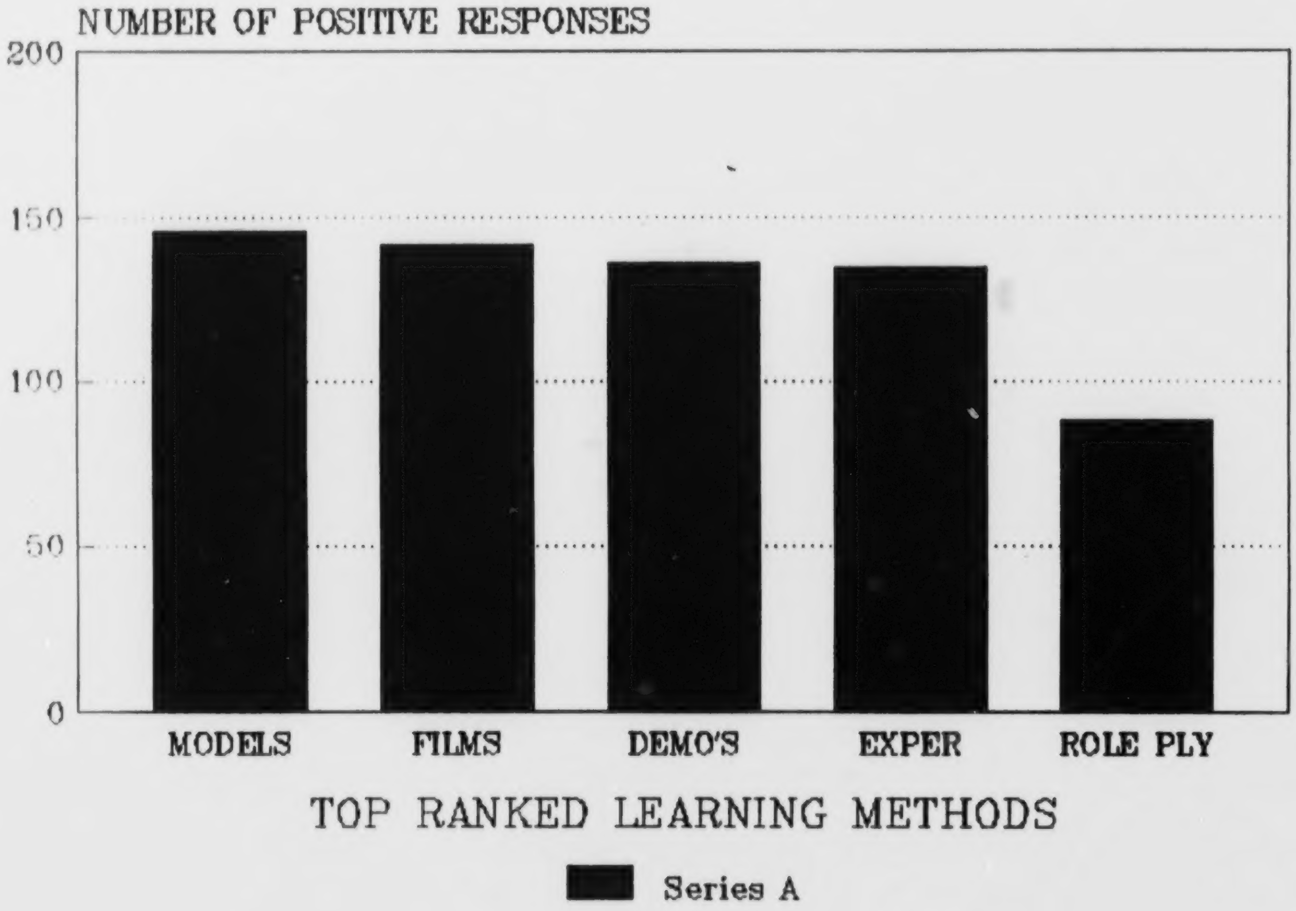
LEARNING METHODS

GRADES 3 - 8 (N=431)



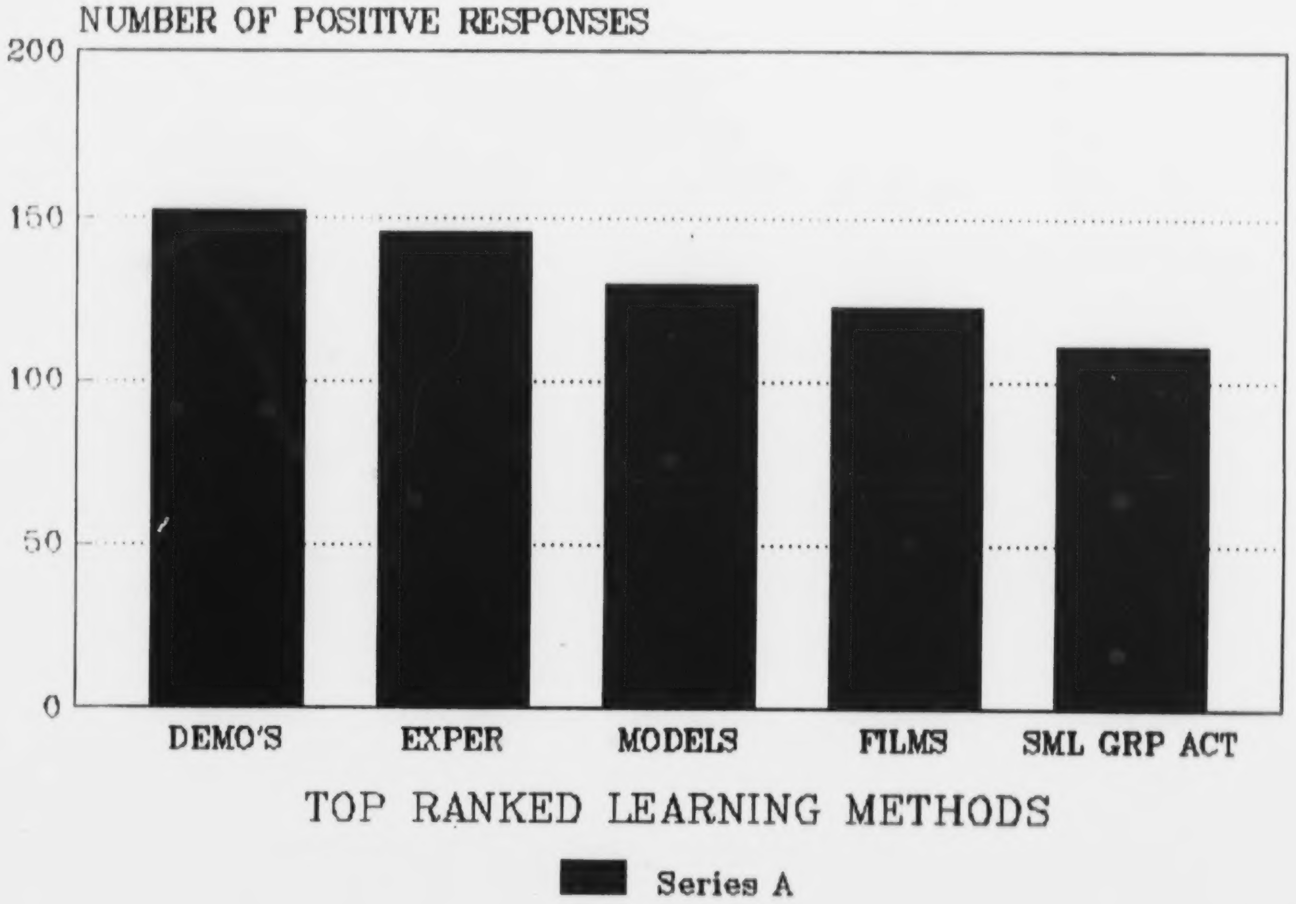
LEARNING METHODS

GRADES 3RD AND 4TH (N=166)



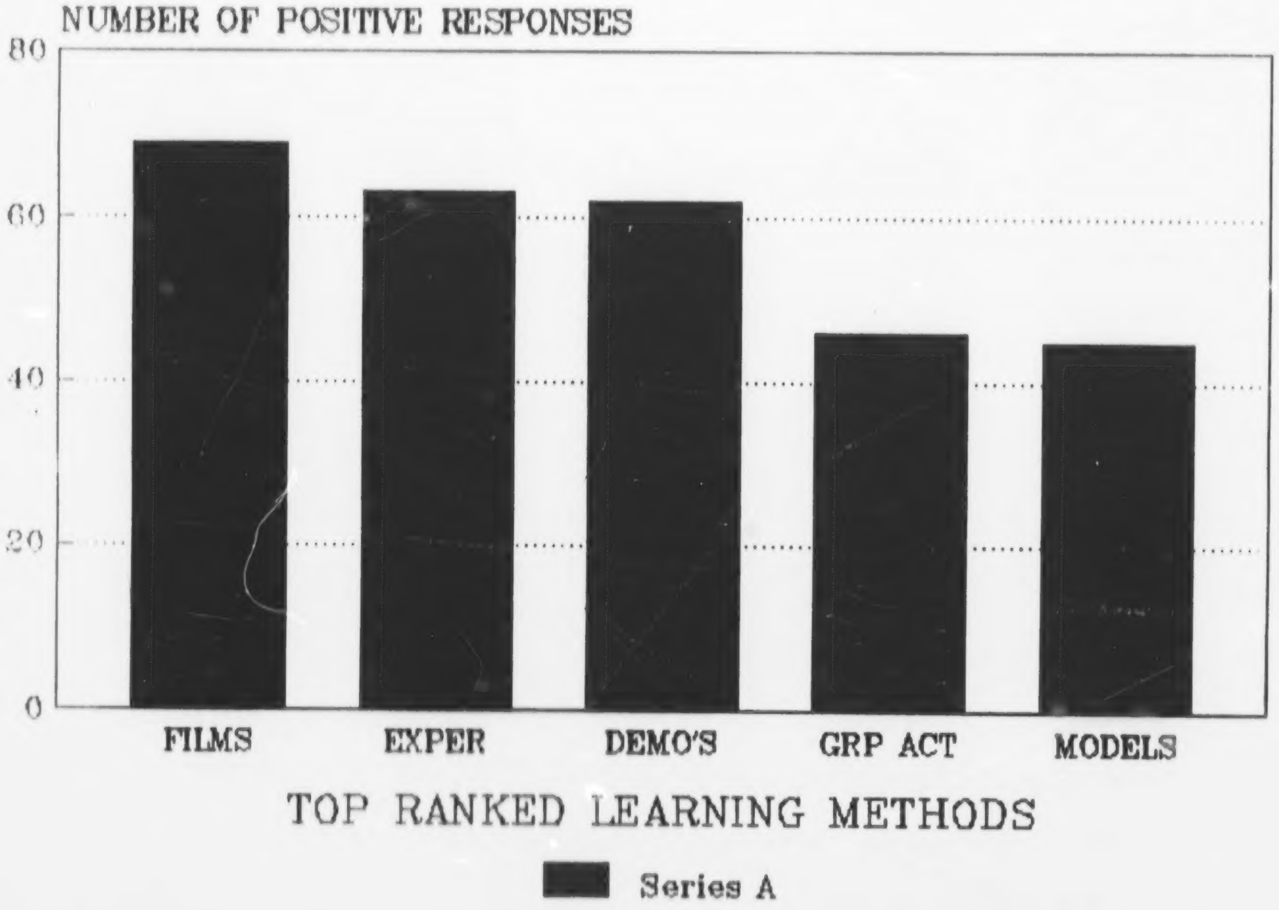
LEARNING METHODS

GRADES 5 AND 6 (N=181)

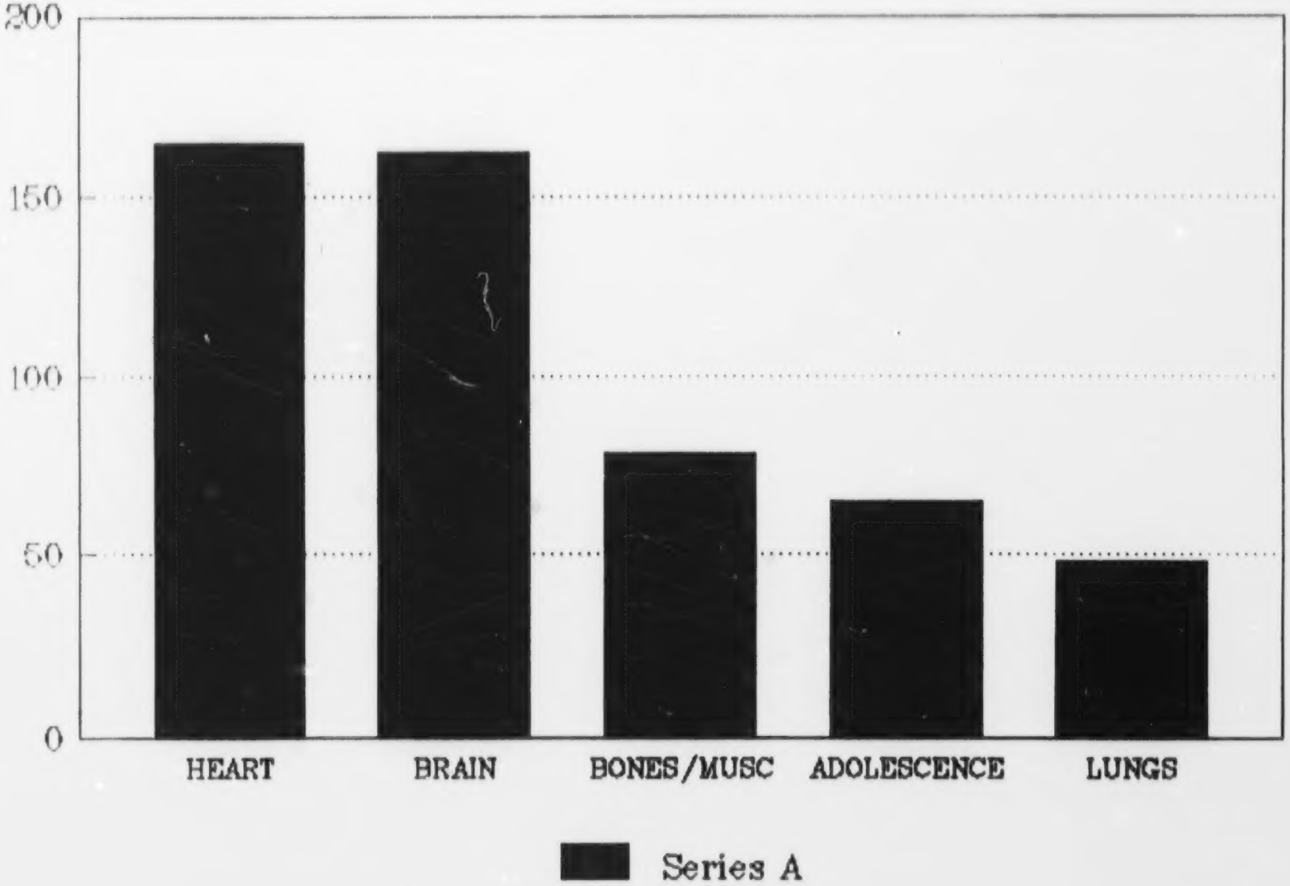


LEARNING METHODS

GRADES 7 AND 8 (N=84)

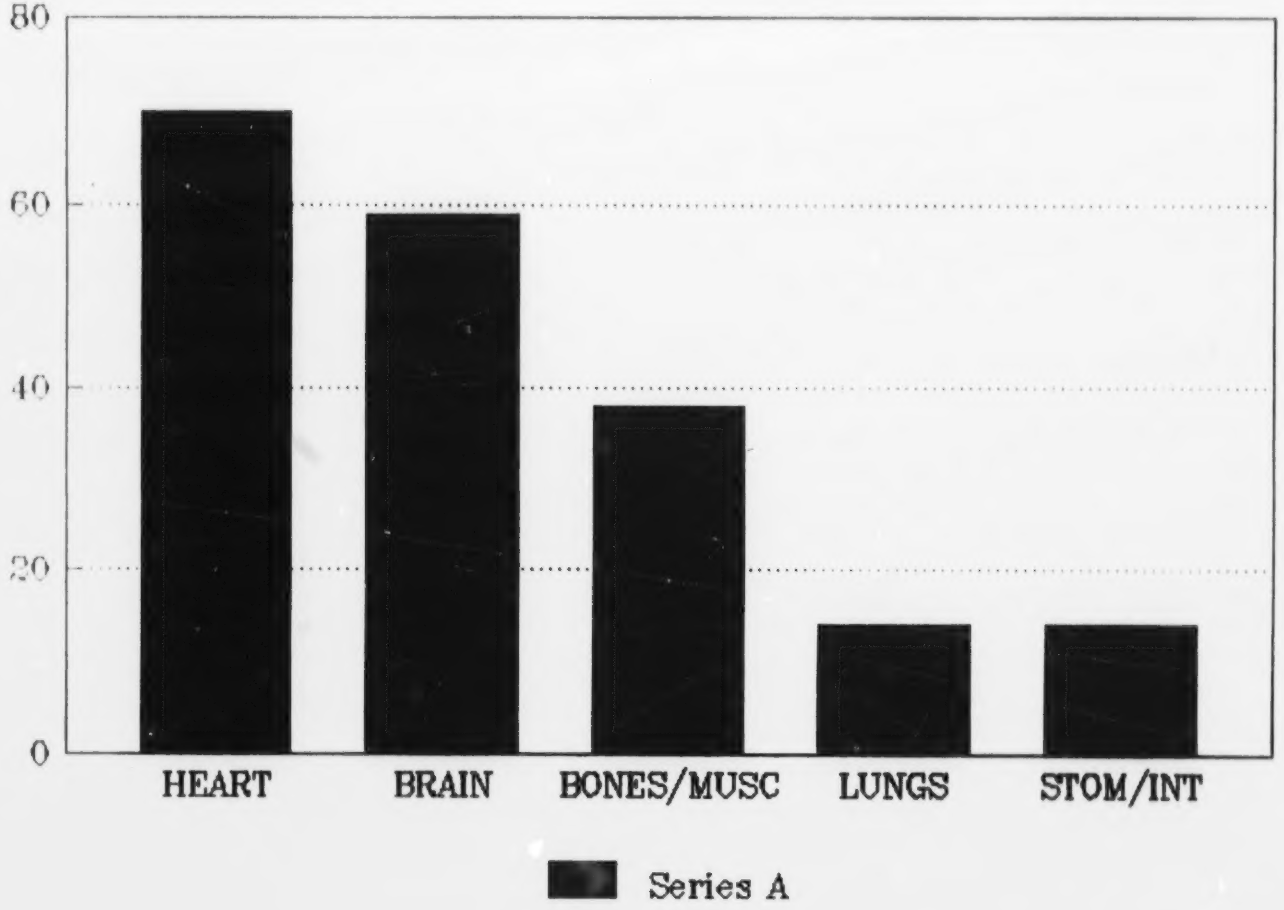


WHAT STUDENTS WANT TO KNOW
431 STUDENTS SURVEYED (GRADES 3-8)



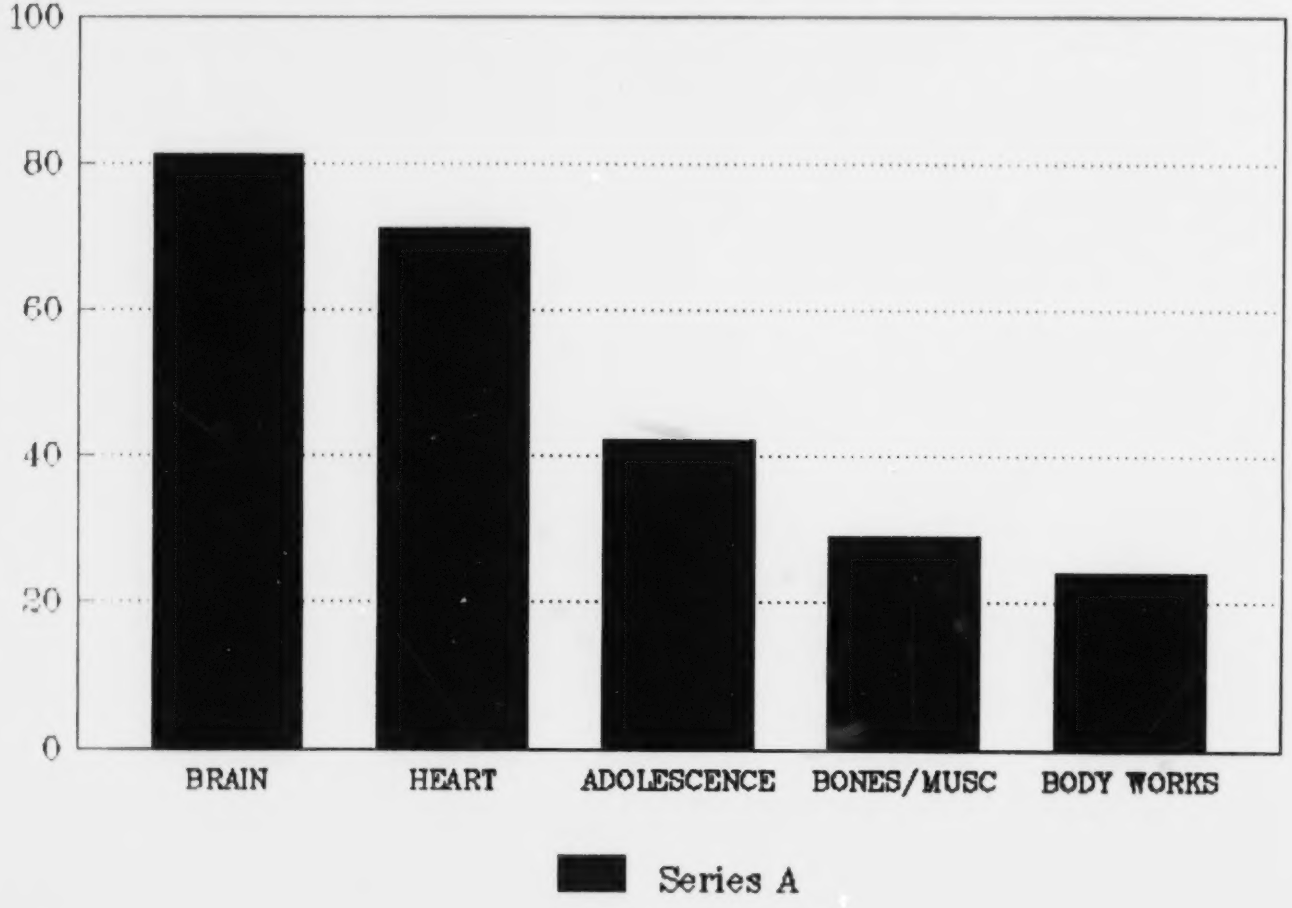
WHAT STUDENTS WANT TO KNOW

166 STUDENTS SURVEYED (GRADES 3-4)

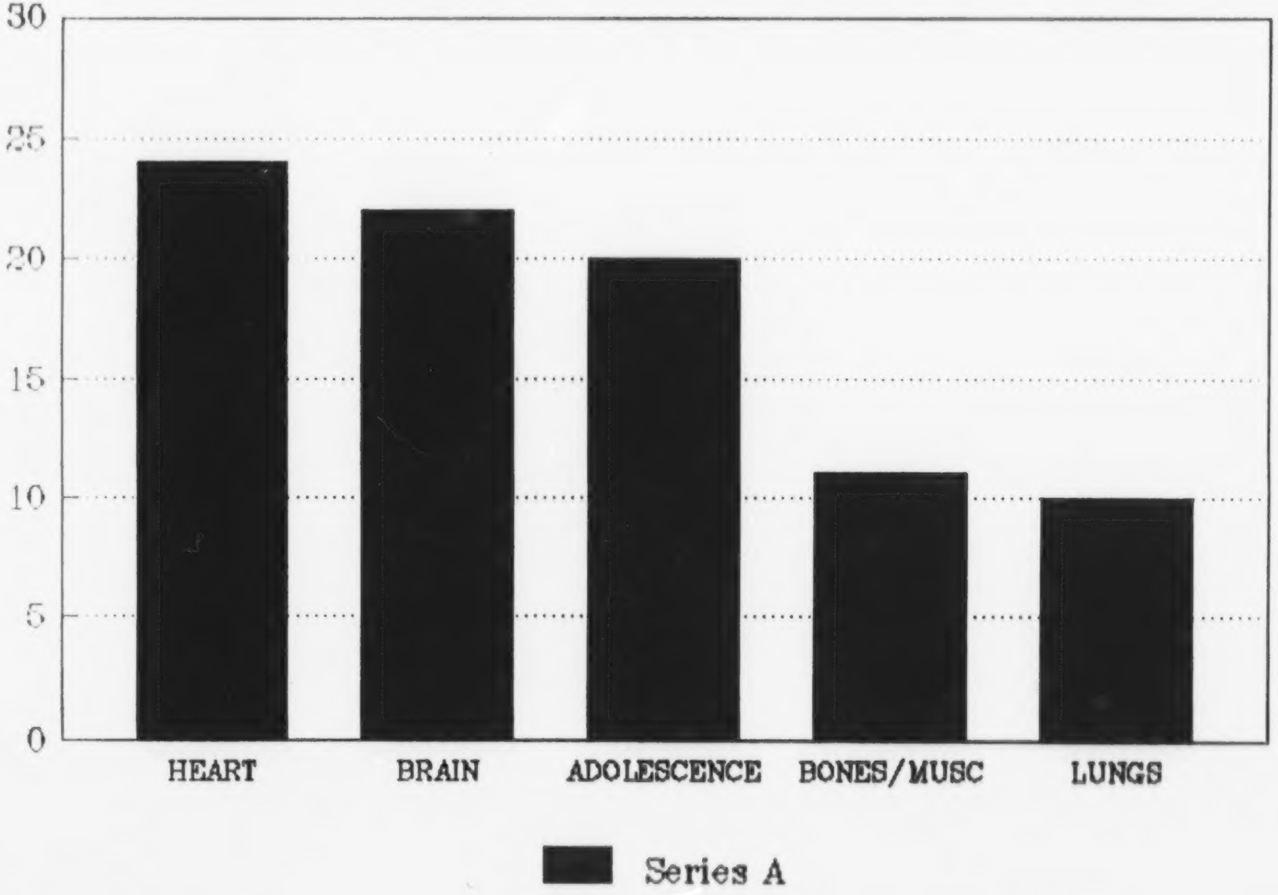


WHAT STUDENTS WANT TO KNOW

181 STUDENTS SURVEYED (GRADES 5-6)

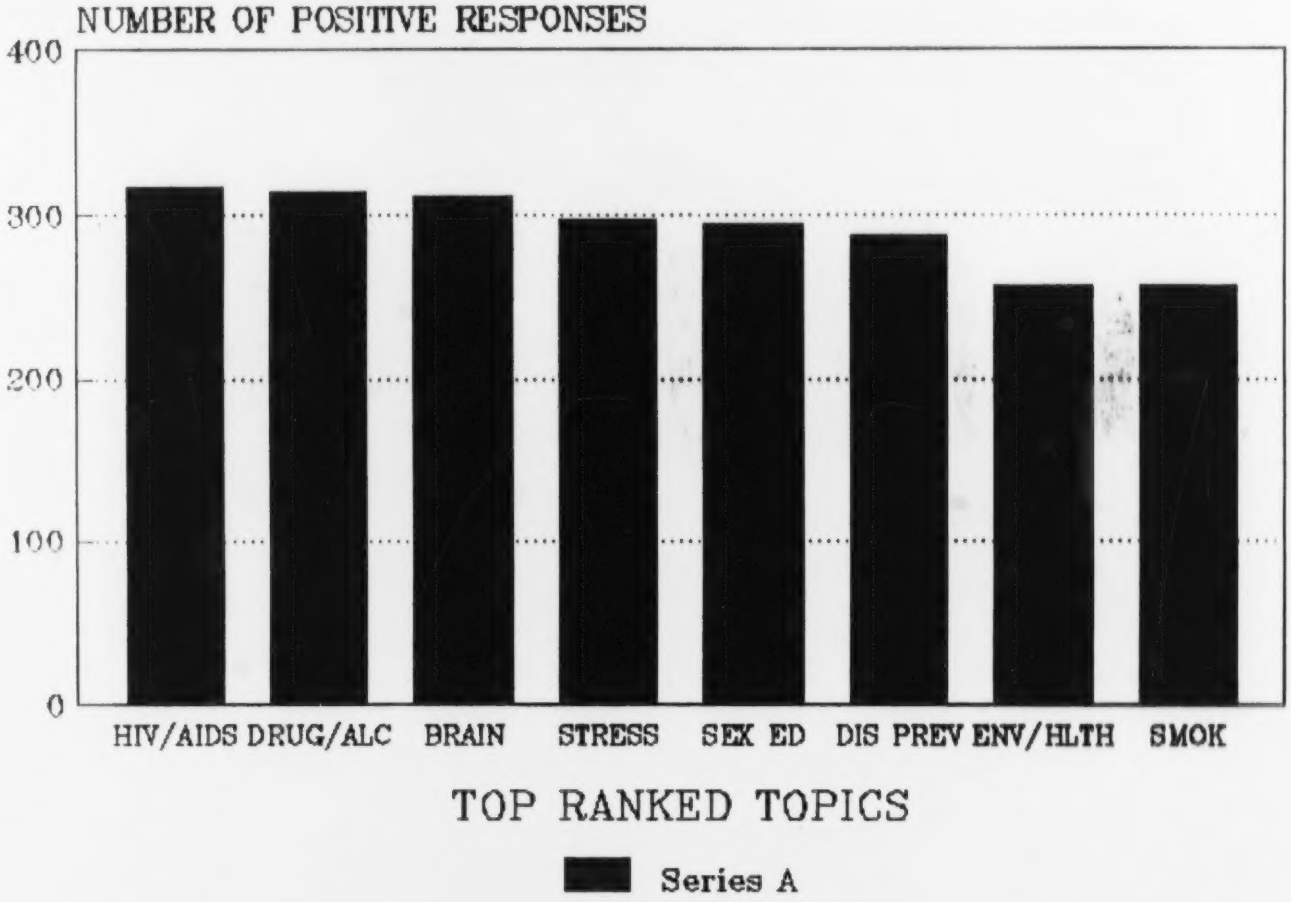


WHAT STUDENTS WANT TO KNOW
84 STUDENTS SURVEYED (GRADES 7-8)



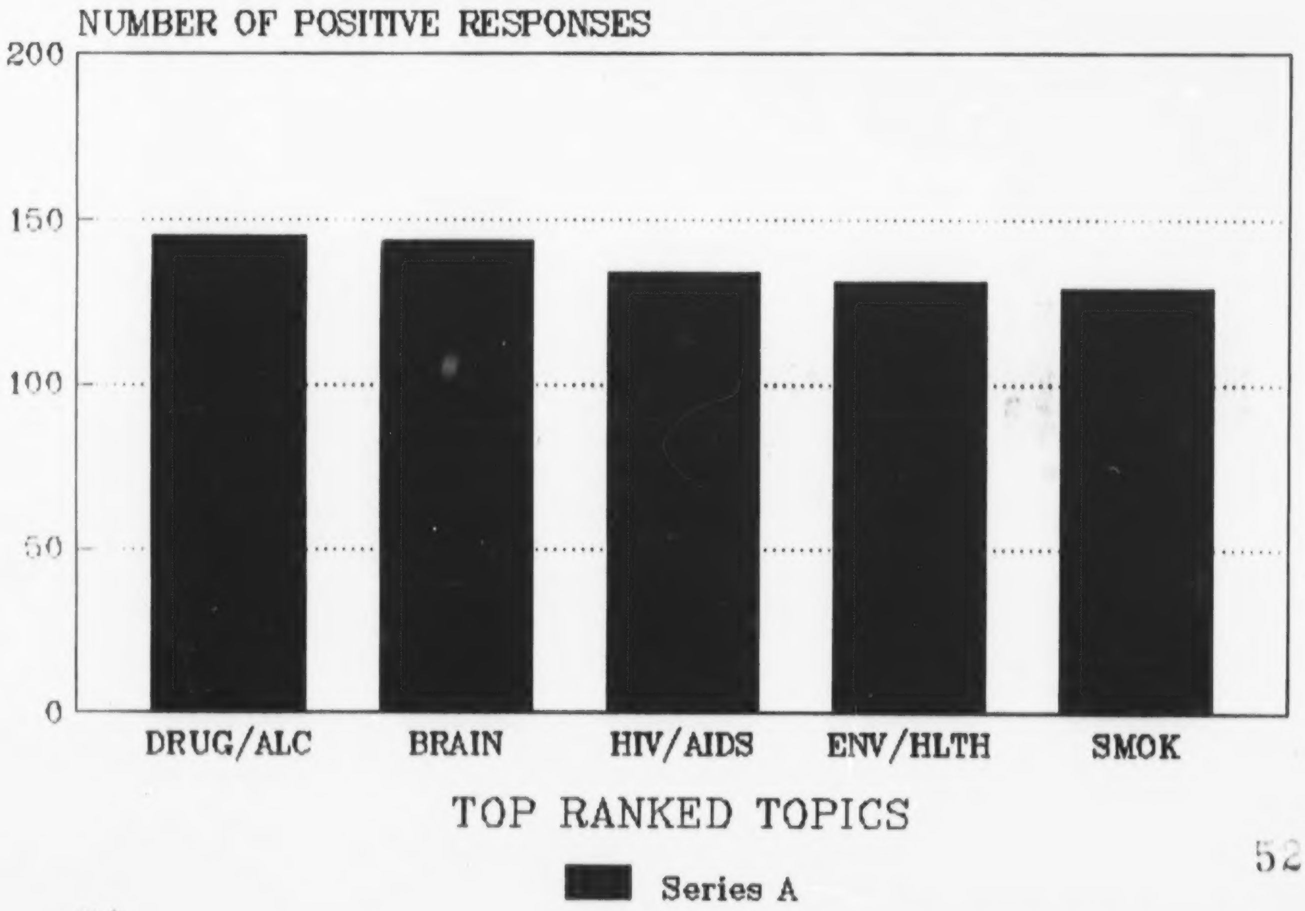
PREFERRED TOPICS

GRADES 3 - 8 (N=431)



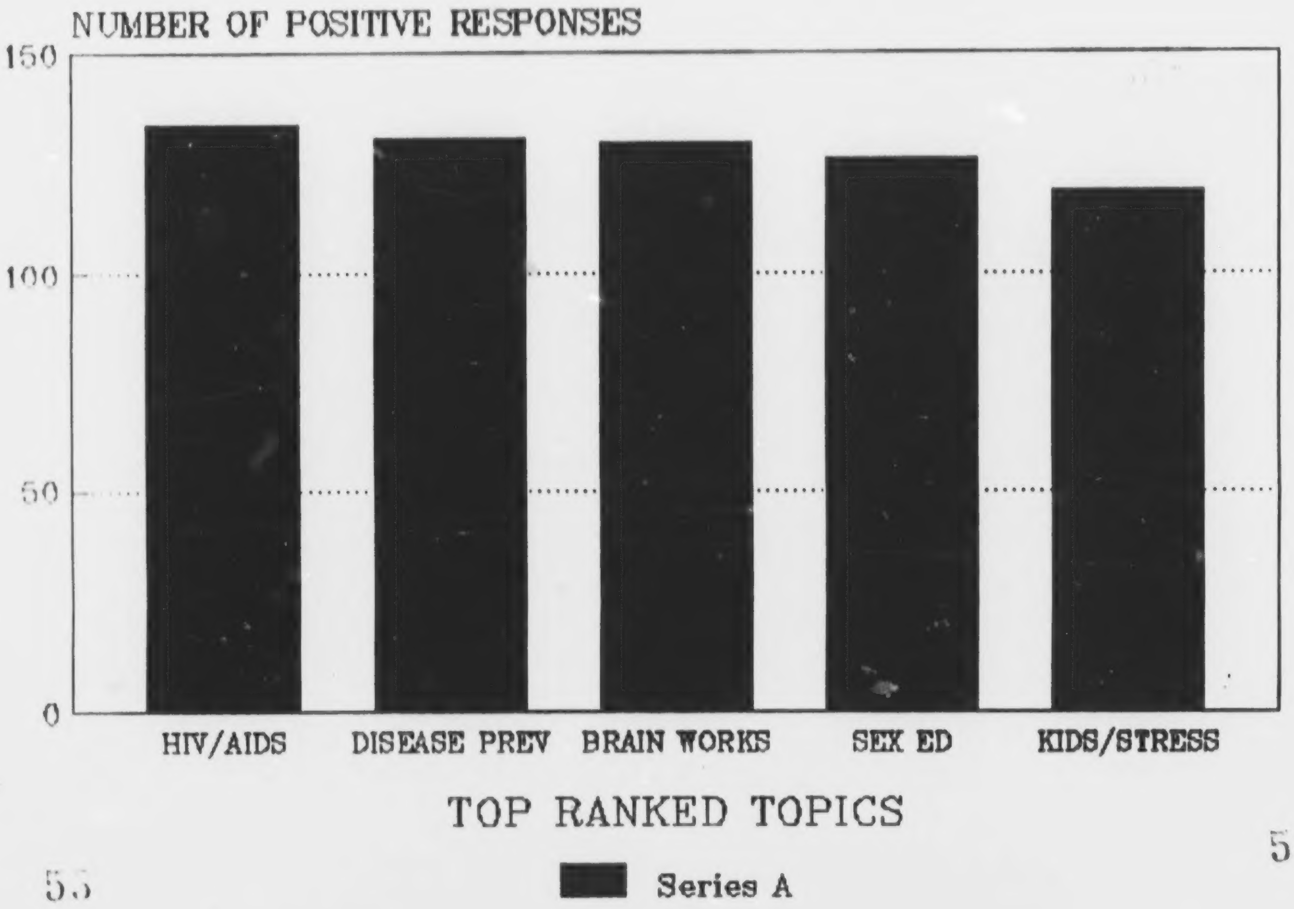
PREFERRED TOPICS

GRADES 3 & 4 (N=166)



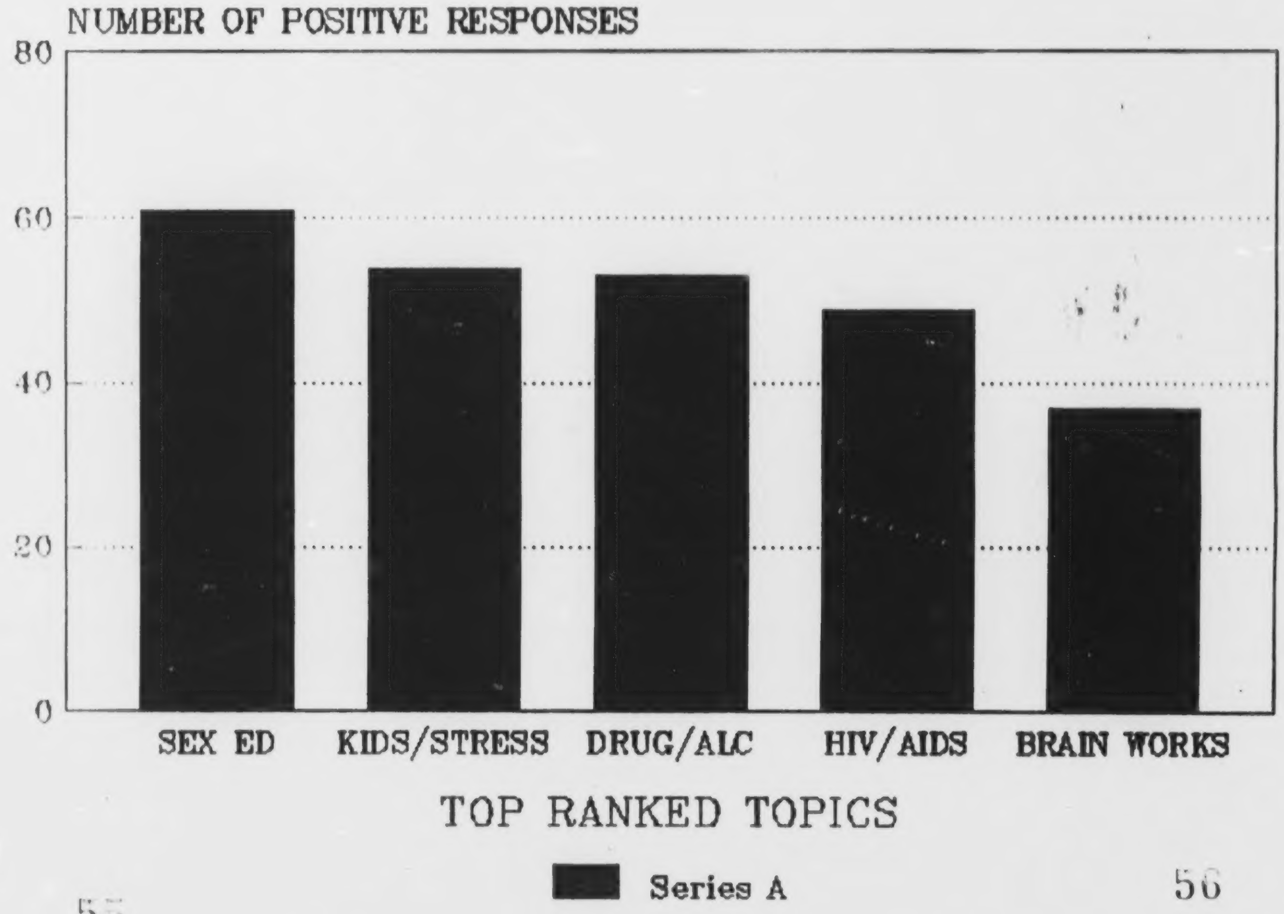
PREFERRED TOPICS

GRADES 5 & 6 (N=181)



PREFERRED TOPICS

GRADES 7 & 8 (N=84)



TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME: Alvin Louis Denmon

INTERNSHIP: Shell Development Co.
Houston, Texas

SCHOOL: Jesse H. Jones High School

PRIMARY SUBJECT: Biology

ACTIVITIES: Environmental resources.

SUMMARY:

RESOURCES: MJ Pierce
Shell Development Co.
P.O. Box 1380
Houston, Texas 77001

Experiment 1: Water — *the Water Cycle*

Level: Junior High School

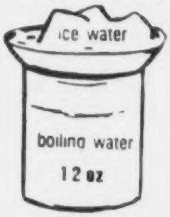
Objective: A partial demonstration of how water recycles itself.

Tools:

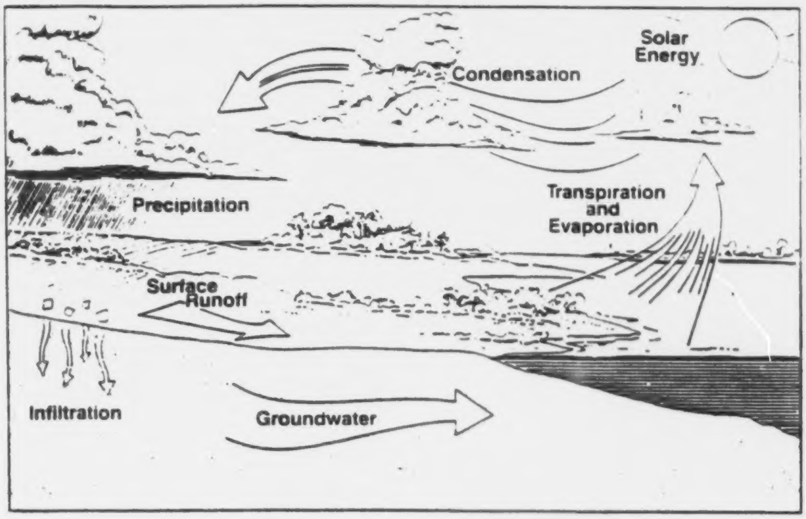
- A 12-ounce glass beaker or drinking glass.
- A round-bottomed glass flask large enough to fit just inside, or to seal off the top of the beaker or glass.
- Enough nearly boiling water to three-quarters fill the beaker.
- Ice water for the flask.

Procedure:

- Pour the hot water into the beaker or glass, ***making certain that the sides are thoroughly wetted.***
- Place the flask, filled with ice water, inside or across the mouth of the beaker or glass. There should be a reasonably tight fit, although it need not seal.
- Observe what happens.


ice water
boiling water
12 oz

Results and Discussion: Describe what you see. Even though this is an artificial situation, can you compare it to something that happens in nature? What do the terms ***evaporation, condensation*** and ***precipitation*** suggest? How do ***they*** occur in nature? Describe what the warm water in the beaker or glass might represent. How about the cold water in the flask? And the drops that formed on the bottom of the flask?


Solar Energy
Condensation
Precipitation
Transpiration and Evaporation
Surface Runoff
Infiltration
Groundwater

Experiment 2 — Ground Water

Level: Junior and Senior High

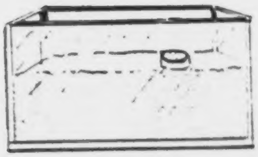
Objectives: To demonstrate the close interrelationship between ground and surface water and the effects of a lowered water table on a pond or wetland.

Tools:

- Five- or ten-gallon aquarium
- Large diameter glass tube
- Lift pump (a large syringe will do)
- **Clean** sand (wash it if necessary)
- Bucket

Procedure:

- Cover the bottom of the aquarium with about an inch of sand.



- Place the glass tube in the corner of the aquarium, against the glass. Hold it upright while the aquarium is half to three-quarters filled with sand. (Take care not to get sand in the tube, which should protrude no more than half an inch or an inch from the sand.)

- Add water to the aquarium until the water level reaches half to two-thirds of the depth of the sand.

- At some distance from the glass tube, dig out some of the sand until a pond appears.

- Using the lift pump or a syringe with a long tip, remove water through the glass tube, dumping it into the bucket.

- Observe the water level in the pond.

Results and Discussion:

More than 90 percent of Florida's drinking water comes from the ground, where it is stored in underground formations called ***aquifers*** which are recharged by rain. Water table aquifers are shallow. Artesian aquifers are deeper and are confined under pressure by an impervious layer of rock, or soil, such as clay.

What kind of an aquifer have you created in the aquarium?

Ground water is pumped through wells to municipal water treatment facilities, or in many cases, directly to our homes. In this experiment, the glass tube represents a well or a wellfield. When water was pumped from your aquifer, what happened in the pond?

As Florida's population increases, it demands more and more water. Discuss the implications of this experiment for Florida's surface waters and wetlands. What does the experiment tell you about shallow ground water, and about surface water in Florida? What happens in your pond when you pour water back down the well? Does that give you any ideas about how ground water might be replenished? Discuss the implications of "artificial recharge." Where would we find the water? What problems might we have?

Experiment 3: Ground Water

Level: Junior and Senior High

Objectives: To demonstrate how easily ground water can become contaminated and the difficulty of cleaning it up.

Tools:

- Use the same setup as the previous experiment.
- Watercolor paints (a bright color; or mix several colors in a pail of water until you have created a suitably ugly wash.)
- A second syringe.

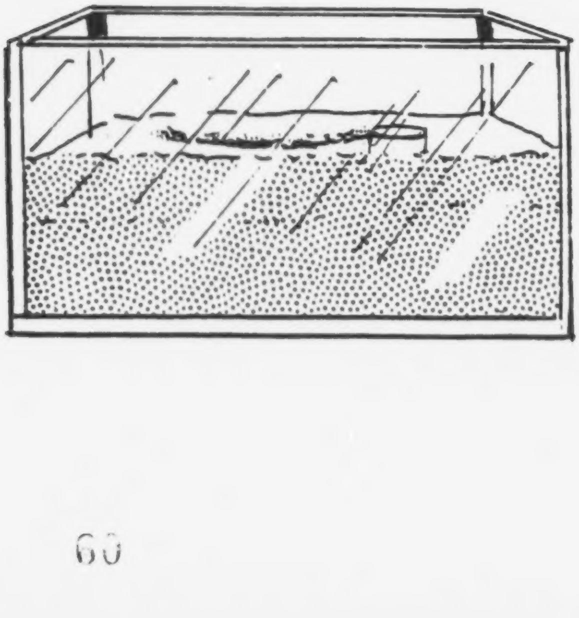
Procedure:

- Refill the aquarium with cleanwater to two-thirds the depth of the sand. Be certain there is water in the "pond."

- Using the second syringe, pollute the ground water by pouring in a sizeable amount of the paint or paint mixture into the pond (or onto the surface of the sand on the side of the pond away from the "well." Observe what happens in the pond).

- With the pump or the first syringe, draw water from the well. Continue. Observe what happens.

Results and Discussion: Discuss the implications of discharging untreated water into surface waters or on the land. How quickly did the pollution migrate from the pond to the well? Consider how you might clean up this ground water. Try pumping more water out of the well. (You probably will have to add clean water to replenish the ground water. Sprinkle it over the surface of the sand to imitate rainfall.) Keep track of how much water you add before the water pumped from the well **appears** to be clean again. Was it a larger volume than the polluted water you added at first? Discuss your clean up options if there had been no rainfall to replenish the ground water.



Experiment 4: Water Pollution

Level: Junior and Senior High

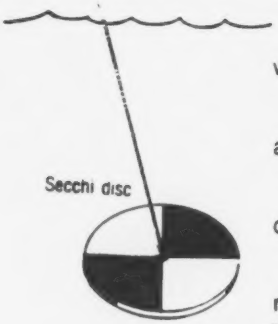
Objectives: To measure the clarity of several different bodies of water and to theorize about causes of unclear water.

Tools:

- Metal disc, such as a tin can lid (be careful of sharp edges. A disc also can be cut in a school shop from a lightweight metal, such as aluminum.)
- A small amount of black paint.
- A small amount of white paint.
- An eye bolt, nuts, and washers.
- Heavy string.

Procedure:

- After the disc is cut, paint it in black and white quadrants. (See Illustration.) This is known as a **Secchi disc.**



- Drill or punch a hole in the center for the eye bolt. Use extra washers on each side of the eye bolt as needed for weight.
- Tie the string to the eye bolt. Mark one-foot, or for greater accuracy, 10-centimeter measurements on the string (knots or paint).
- From a dock or boat, lower the disc into a stream or pond until it disappears. Make a note of the depth.
- Lower the disc a foot or two, then raise it slowly until it reappears. Note the depth. Average the two depth readings to find your **limit of visibility.**

Results and Discussion: The limit of visibility is approximately the depth where photosynthesis and respiration are balanced — where about 5 percent of the light that penetrates the surface is transmitted. The light that reflects back to your eye from the disc has traveled from the surface, to the disc and back, indicating that the absolute limit of light penetration is about twice your limit of visibility.

Take readings from several different bodies of water — fast and sluggishly moving streams, salt water, fresh water, swamps, lakes, etc. Discuss what might influence the depth that light will penetrate in each. Sediment in moving water is an obvious cause. If you have a brown-water stream that drains a swamp in your area, you will note that the swamp itself can be clear, but that light penetration still is limited. Why? Is there a relationship between the limit of visibility, plant growth, or animal life? Are there more or fewer plants and animals in highly turbid waters than in clear waters? Note how the Secchi disc seems to change color at different depths. Why?

Experiment 5: Water Pollution

Level: Junior and Senior High

Objective: To see the effect of excess nutrients on water quality.

Tools:

- Five glass or plastic containers (the large, clear plastic soft drink bottles, with tops cut off). Each should hold about 2 liters.
- Fresh water from a clean pond or lake. (Tap water may be used, but it should stand in an open container for a day or two so it will lose any chlorine added in the water treatment process.)
- Assorted fresh water plants and small animals (algae, water lettuce, Elodea, Daphnia, freshwater shrimp, etc. obtained from the pond or lake or from a tropical fish store or laboratory supply house.)
- Plant fertilizer (liquid house plant fertilizer.)
- A hand lens or low-power microscope.

Procedure:

- Fill each container with an equal amount of water. Number the containers 1 to 5.

- Set container 1 aside. Add the Daphnia or freshwater shrimp to containers 2 and 3; put the algae, water lettuce or Elodea into containers 4 and 5. Label the containers with the material they contain.

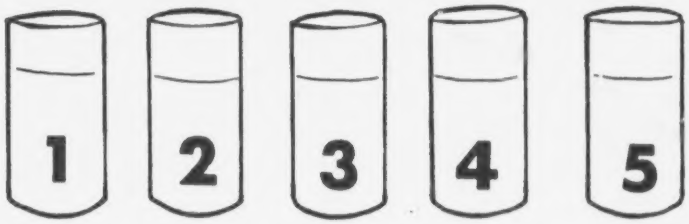
- Put equal amounts of the liquid fertilizer (diluted to the strength recommended on the label for house plants) into containers 2 and 4. (A tablespoon should be enough.) Stir.

- Set all the containers on a window sill and examine them daily for 3 or 4 days.

Results and Description: After the first 24 hours, what happened to the Daphnia or the shrimp in container 2? After 3 or 4 days, what happened in container 4. Describe it in detail. Has anything happened in container 1? Describe. Examine containers 3 and 5. Has anything changed? Describe. The experiment may be continued for a week or more. Describe what happens as time goes on.

How would fertilizers get into our waterways in the "real" world?

Examine the label on the container of house plant fertilizer. Which of the ingredients are nutrients? What could happen to our streams and rivers if large amounts of nitrogen and phosphorus escape into them? List several sources of these materials and how they might reach a stream or lake. How can we keep this from happening?



Experiment 6: Water Pollution

Level: Junior High

Objective: To demonstrate how easily water can be contaminated by common materials.

Tools:

- A supply of small, clean, wide-mouth jars or pill vials with watertight tops (the number depends upon the number of "contaminants" you choose).
- A larger jar.
- The "contaminants": moderate amounts of such materials as oil (any kind, from motor oil to cod liver oil), ink, fine sawdust (the residue from a pencil sharpener, including powdered graphite), loose tobacco, hard candy, sugar, coarse gravel, powdered chalk, soap, some dried beans, etc.

Procedure:

- Fill each of your containers with water. Set one of them aside as a **control.**

- To each of the remaining containers, add one of the contaminants. Cover and label each.

- Shake each container and observe the results.

- Set the containers aside and observe them for a few days.

- After three or four days, shake them up again, then open the containers and examine them. Dip your fingers in each and rub them together. (Do not **taste** any of the concoctions.)

- Mix the contents of all the containers. See what you have now!

Results and Discussion:

Describe what happens to the material in each container. Some will dissolve into the water right away. Some will float. Some will appear to mix, then will separate after setting for a while. Some will settle out. Before the containers are mixed together, each should be compared with the control that was set aside at the beginning. The mixture, too, should be compared.

The experiment shows what can happen when material that is not meant to be in water is placed in it. Think of your contaminants as materials discharged as wastes by a community or industry.

Experiments 7, 8 and 9 show how pollutants can be removed from water. But, isn't it better to keep them out of the water in the first place? (When you have finished with those experiments, you might try the concoction that was formed when the containers were poured together to see whether or how much it can be cleaned.)

Experiment 7: Waste & Water Treatment

Level: Junior High

Objective: Demonstrate a simple way that polluted water can be cleaned — through filtration.

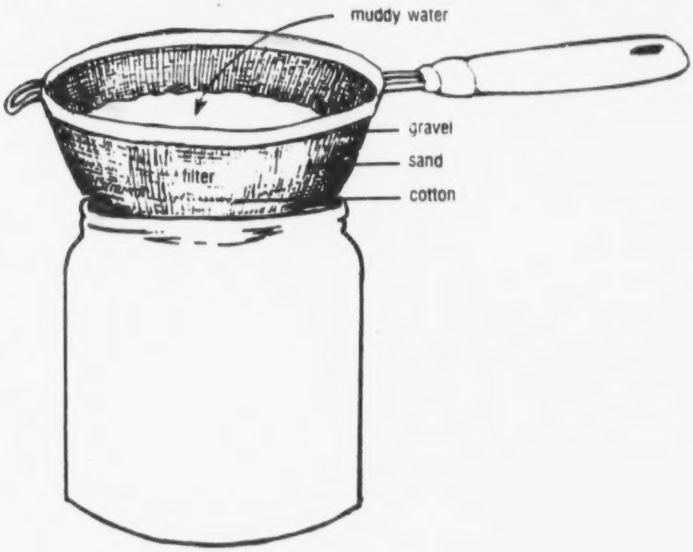
Tools:

- A kitchen sieve, a kitchen flour sifter, or an empty can with fine window screen in place of the bottom.
- Absorbent cotton
- Coarse sand
- Gravel
- A good-sized jar
- Some muddy water

Procedure:

- Cover the screen with a thick layer of cotton.
- Add an inch-thick layer of the coarse sand.
- Add an inch of gravel.
- Place your just-built filter over the jar. Stir, and slowly pour the muddy water through the filter.

Results and Discussion: Watch what happens. Is the water still muddy after it has passed through your filter? Is it completely clean? What situations in your community might be analagous to your small filter? Perhaps your city offers tours of the water treatment or sewage treatment plants. Can you spot where these huge facilities do what you just did but on a much larger scale? For this and the next two experiments, you also might experiment with some of the "contaminants" from Experiment 6.



Experiment 8: Waste and Water Treatment

Level: Junior and Senior High

Objective: To demonstrate another step in the waste or water treatment process — coagulation.

Tools:

- The jar of filtered water (still slightly muddy). (If there was no sediment left after filtration, add a small amount of mud — enough to add a brown tinge to the water).
- Alum
- Clean water
- A cup

Procedure:

- Grind ten or twelve crystals of the alum and dissolve them in the clean water in the cup.
- Shake the muddy water in the jar, and stir in the alum solution.
- Rinse the cup and add the rinse water. Continue to stir for a few minutes.
- After about five minutes, let the jar stand.

Results and Discussion: Describe what happened after the alum was added to the water. What was formed, and what was its purpose? How long did it take for the material to settle? Was the water above the settled floc clear? If you wish and if there still is some color in the water after coagulation, you might try pouring it through another (clean) filter as in Experiment 7.

Experiment 9: Waste and Water Treatment

Level: Junior and Senior High

Objective: Observe the ability of activated carbon to remove contaminants which pass through a "traditional" sand filter.

Tools:

- Two one-inch diameter plastic tubes, 18 inches long. (Golf club separator tubes or PVC pipe.)
- Activated carbon (used in fish tanks), enough to fill one tube.
- Clean coarse sand (from experiment 7), enough to fill the other tube.
- Two small squares of cloth (2x2) and two rubber bands.
- A stand, or something that will hold the tubes upright.
- Two beakers or small pans to catch the water after it passes through the tubes.
- Cotton balls.
- Food coloring.

Procedure:

- Place two or three cotton balls in one end of the plastic tubes. The cotton will separate the sand or charcoal from the cloth caps.

- Using the rubber bands, attach the cloth squares over the end of the tube below the cotton balls. These cap the tubes so the filtering material cannot fall out.

- Fill one tube to within two inches of the top with coarse sand. Tap on the sides of the tube to ensure that the sand settles.

- Fill the second tube to within two inches of the top with activated charcoal. Tap the tube several times to ensure that the charcoal settles.

- Set the tubes over a beaker or small pan.

- Mix food coloring into one pint (400-500 milliliters) of water, then divide the mixture into two containers.

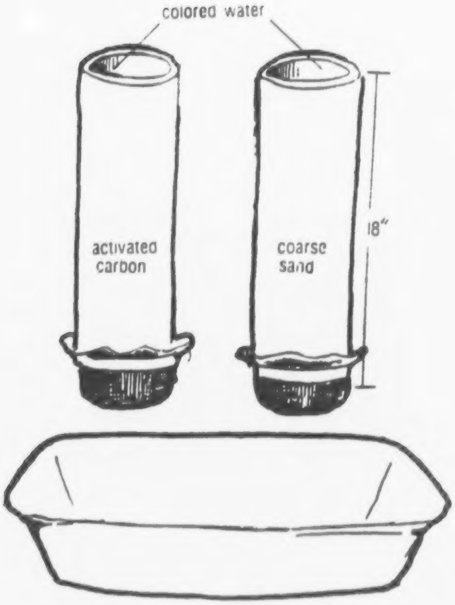
- Pour colored water into each tube.

(NOTE TO TEACHER: You might run through this experiment beforehand to determine the proper amount of food coloring to mix into the water. If too much color is used, the activated carbon may not remove all of it. Be certain the carbon is tightly packed into the tube.)

Results and Discussion:

Is there a difference in the water that comes through the two tubes? Describe it. Why does the carbon do a better job of removing the color?* Is activated carbon treatment better suited for wastewater treatment, or treatment of drinking water before it reaches your faucets at home?

*Microscopic cracks and crannies in the activated carbon attract and hold the molecules of color in the solution. The sand, on the other hand, has a hard, relatively smooth surface which allows the color molecules to slide through.



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Experiment 10: Air Pollution

Level: Junior High

Objectives: Build and use simple air pollution (particulate) detectors.

Tools:

A.
- Several glass or plastic slides or small panes of glass.
- Flat stick (lath), 2 or 3 feet long. A yardstick is fine, too.
- Jaw-type clip
- Nut and bolt
- Vaseline

B.
- Yardstick
- Paper plate
- Thumbtack
- Vaseline

Procedure:

A.
- Bolt the jaw-type clip to the lath or yardstick.

- Smear an evenly thin layer of vaseline over the top of the slide or glass and place it in the jaws of the clip. (A separate slide might be covered with vaseline and put in a protected space as a "control.")

- Set the sampling tool outside. (If you made more than one sampler, set them in areas such as near a street, in a protected garden, etc. for comparative purposes.)

- After several hours, or a day of exposure (same time for all samplers), examine the slides through a microscope. Compare slides from different locations and from the protected space.

B.
- Tack a paper plate to the yardstick.

- Smear the plate evenly with vaseline.

- Hold the plate near the exhaust pipe of a car while it is running. (With different plates, sample several cars — old and new).

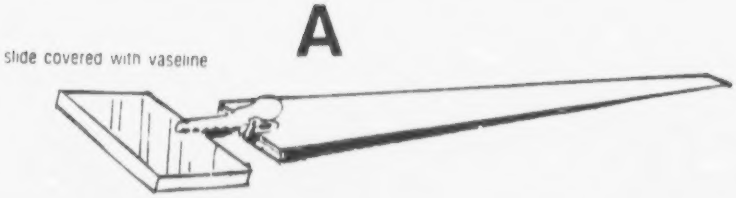
Results and Discussion:

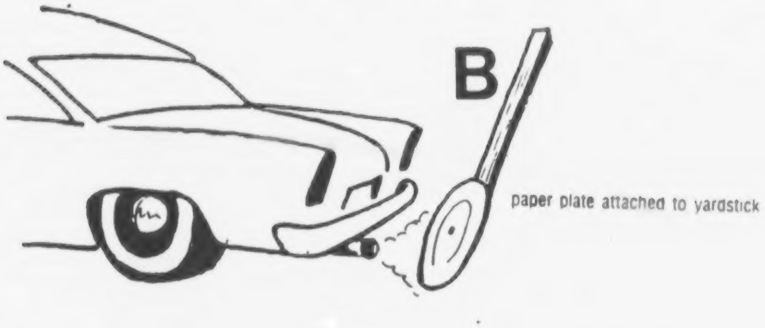
A.

Compare the slides that were exposed to the air with the one you had protected. Was there a difference? Compare the amount of material trapped in the vaseline on slides exposed at different locations. Can you explain any differences you find? If you placed some slides near where construction was occurring, or near roads, what kinds of pollutants might be found on each slide?

B.

Is there any difference between old and new cars? If you know, is there a difference in cars that are burning different grades of fuel? You might run the experiment with a car as it starts after it has sat for a night, and compare it to a car that is idling after it has warmed up for a time. Can you explain any difference? Compare a gasoline powered car with one powered with diesel fuel.




B
paper plate attached to yardstick

Experiment 11: Air Pollution

Level: High School

Objectives: To determine whether the air you breathe contains suspended fine particles that may soil fabric or other material.

Tools:

- Small vacuum pump or water aspirator with an air volume capacity of about ¾ cubic foot per minute.
- Two pieces of 28-mm outside diameter glass tubing, 50-75 mm long, with 1.2-mm wall thickness.

NOTE: Here, and elsewhere where glass tubing is required, observe proper safety measures by assuring that ends are cut square and are fine polished to avoid cut fingers.

- A 28-mm diameter disc of window screen.
- Two rubber stoppers to fit the glass tubing, each with an 8 mm hole in center.
- Two 75-mm pieces of 8-mm outside diameter glass tubing.
- Whatman #44 filter paper — 28-mm discs.
- One-inch wide rubber band to fit snugly around 28-mm tubing, or one-inch wide masking tape.
- Burette stand with a 3-finger clamp.
- Plastic or rubber tubing to connect filter to vacuum pump and to act as a probe to collect outside air.
- Flow meter (or rotameter) of appropriate range or a wet or dry gas meter if available. A critical orifice of proper size may be used to control air flow at the desired maximum rate.
- One-gallon glass bottle fitted with a two-hole rubber stopper containing one long and one short piece of 8-mm glass tubing. The bottle should be nested in a cardboard box for safety.
- Small metal or plastic funnel.

Procedure:

Assembly:

- Set the screen on top of one piece of 28-mm tubing (now called cylinder 1).

- Place a filter paper disc on the screen.

- Place the other piece of 28-mm tubing (cylinder 2) on top of the filter paper, press the two cylinders together, and make an air-tight seal with the rubber band or the masking tape.

- Place an 8-mm glass tube in a hole through each rubber stopper. Place one stopper in the lower end of cylinder 1 and the other in the upper end of cylinder 2. Mount the assembly in the burette stand, with cylinder 2 in the upper position.

- Using plastic or rubber tubing, connect cylinder 1 to the lower tap on the rotameter or, if you are using one, to the inlet of the other type of flow measuring device. Connect the outlet of the rotameter or other flow meter to the inlet side (long glass tube) of the one-gallon bottle. (The bottle evens out any fluctuations caused by the vacuum pump. It is called a surge or buffer bottle.)

- Similarly connect the outlet tube from the surge bottle to the inlet tap of the vacuum pump or other source of vacuum.

- Connect a long piece of plastic or rubber tubing to the inlet end of cylinder 2, and pass the other end through a window. The stem of the funnel should be inserted in the tubing that is hanging outside. The funnel should hang upside down to prevent rainwater from entering the tubing.

Operation:

- Start the vacuum pump and record the time.
- Measure and record the rate of air flow.
- Allow air to pass through the filter for two hours, or as long as required to noticeably darken the filter paper.
- Measure and record the rate of air flow.
- Stop the vacuum pump and record the time.
- Dismantle. Observe the soiling of the filter.

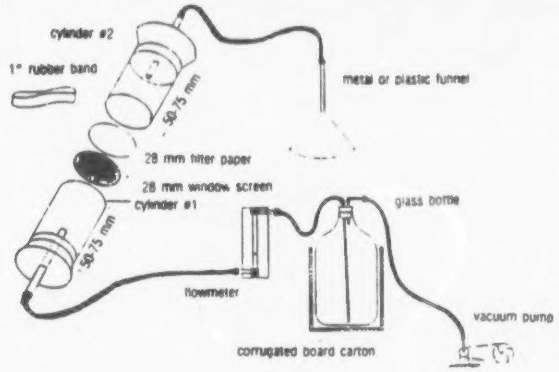
- OPTIONAL: If a photometer to measure the transmittance of light through the soiled filter paper is available, a quantitative evaluation (see below) of the amount of soiling can be made.

Quantitative Evaluation:

The amount of discoloration on the filter paper is about proportional to the quantity of solid particles suspended in the air. This makes it possible to relate the decrease in light transmittal through the paper to the amount of dirt particles collected on it. The transmittal of light through the paper will be measured before and after filtering the air by placing the clean filter disc and later the soiled discs against the photometer window and noting the intensity of light transmitted in each test.

From these measurements, the optical density of the soiled filter paper can be computed in terms of COHs (Coefficient of Haze — one COH represents an optical density of 0.01). The optical density of the deposit or soiling is the logarithm to the base 10 of the ratio of the intensity of light transmitted through the clean filter paper to the intensity of the light transmitted through the soiled filter paper. In terms of percentage, it can also be the ratio of percent transmittance through the clean paper (100%) to the percent transmittance through the soiled paper.

Therefore: $\frac{I_o}{I_t} = \log_{10} \frac{100\%}{\%T}$



Where:

Io = average light intensity transmitted through clean filter paper

It = light intensity transmitted through the soiled paper, and

%T = percent light transmitted through the soiled paper when the light transmittance through clean paper is considered as 100%

Since $\log_{10}$ of 100 = 2.0, we have:

0.D. = 2.0 − log %T

By definition, one COH unit equals an optical density of 0.01. Thus the number of COHs represented by the actual 0.D. found equals 0.D./0.01 = 100 × (2.0 − log %T).

COH unit measurements are usually represented as COHs per 1,000 linear feet of air passed through the filter paper. The concept of linear flow, upon which the expression of COHs per 1,000 feet is based, considers that through each point on the surface of the filter a long stream of air passes and deposits its load of dirt particles. One might think of the sample as a long column of air the same diameter as the diameter of the exposed filter paper and with a volume equal to the measured volume of the air sample.

Computations:

- Volume of air = $R_2 - R_1$ (for dry or wet gas meter)

Where:

- R_2 = final reading in cubic feet
- R_1 = original reading in cubic feet

or, (for rotameter or critical orifice:

Volume of air = $t(F_1 + F_2)$
2

Where:

F_1 = initial flow rate in cubic feet per minute
F_2 = final flow rate in cubic feet per minute
t = sampling time in minutes

- Area:

$3.14 \times d^2$
4 where d is the inside diamter of the cylinder in feet

$$\text{feet} = \text{mm.} \times \frac{\text{cm.}}{\text{mm.}} \times \frac{\text{in.}}{\text{cm.}} \times \frac{\text{ft.}}{\text{in.}}$$

- Linear feet of air:

volume
area = L

- COHs per 1,000 feet

$$\frac{(2.0 - \log \%T) \times 100}{L/1000}$$

$$= \frac{(2.0 - \log \%T) \times 100 \times 1000}{L}$$

$$= \frac{(2.0 - \log \%T) \times 10^3}{L}$$

Experiment 12: Air Pollution

Level: Junior and Senior High

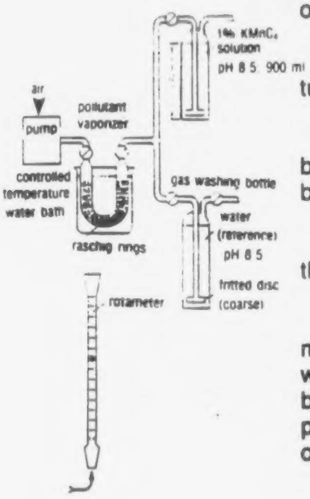
Objective: To show one way to keep odors out of the air.

Tools:

- Oilless gas pump (approximately 2 liters per minute capacity.)
- Pyrex U-tube, packed with Raschig rings or glass beads.
- Beaker to hold U-tube.
- Two fritted bubblers, or equivalent.
- Rotameter or other means of measuring gas flow.
- Glass or plastic tubing.
- Stopcocks or pinchcocks.
- pH indicator.
- Rubber stoppers for U-tube and bubbler flasks.
- Reagents:
  - Odorous material (hydrogen sulfide or mercaptans are suggested.
  - Potassium permanganate
  - Buffer material, such as borax, sodium carbonate or bicarbonate.

Procedure:

- Assemble materials: see illustration. If fritted discs are not available, improvise to break up the gas into very small bubbles. (The smaller the bubbles, the greater the surface area for contact with the solution for a given volume of gas and the greater the efficiency of oxidation.)



- Place the liquid that contains the odorous vapor or gas in the U-tube so the Raschig rings or glass beads are thoroughly wetted.
- Put 900 milliliters of 1% potassium permanganate solution, buffered to pH 8.5 with borax, sodium carbonate or sodium bicarbonate, into one of the flasks.
- Put the same amount of distilled water, buffered to pH 8.5, into the other bubbler flask.
- Start the gas pump and adjust the rate of flow to 2 liters per minute passing through the U-tube; flow through each bubbler flask will be at 1 liter per minute. By using water or ice in the U-tube beaker, heat or cool the liquid in the U-tube according to its vapor pressure so the air stream will be loaded to the maximum with the odorous gas or vapor.
- Observe and record the nature and intensity of the odor emitted from each bubbler flask.

Results and Discussion: This experiment demonstrates just one of a number of ways odors can be removed. Activated carbon also can be used for some odors, and others can be removed by direct exposure to a flame.

Discuss local factories or other activities such as dairy farms, sewage treatment, etc. which might need to control odors.

Experiment 13: Field Experiment

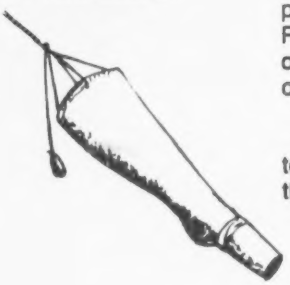
Level: Junior and Senior High

Objective: Collect and study the plankton that make up the base of the food chain for marine and aquatic organisms.
NOTE: This experiment can be done in either fresh or salt water.

Tools:

- One leg of a nylon panty hose or a nylon stocking.
- A wire coat hanger or a plastic milk jug.
- Needle and thread.
- Duct tape.
- A vial or small bottle, plastic or glass (one with a lip).
- Strong cord.
- A small fishing sinker.
- A boat and motor (not necessary, but recommended. A rowboat may be used if you have a strong rower.)

Procedure:



- Twist the coat hanger into a ring. Attach the wide end of the panty hose leg to the coat hanger, using the needle and thread. Reinforce the stitching with the duct tape. Alternatively, the stocking or panty hose can be stitched to the milk jug after its bottom and part of the top have been cut out (see illustrations).

- Attach strong cord to three places on the ring, knotting the string together a foot or so in front of the net, or tie string to the handle of the jug.

- Add cord for a towing line.

- Cut open the toe of the stocking, and tie on the small catch bottle, making certain that the string is tight around the lip.

Results and Discussion:

Using the net: Plankton nets can be towed by hand through the water, or can be pulled behind a boat, either one with a motor or rowed. The net should be pulled fairly fast to keep it off the bottom or you will collect more than plankton. Smaller nets can be attached to a fishing rod and reel, cast out over the water, and reeled in.

As you pull the the net though the water, tiny drifting organisms are trapped by the net and wash down the side into the catch bottle.

You can study your catch back at school. How many of the organisms you collected can you identify? What is the proportion of plants to animals? Can you suggest a reason why this might be?

Discuss the position of the plants (phytoplankton) and the animals (zooplankton) in the food chain. Discuss the importance of phytoplankton in the food chain and in maintaining air quality. What happens to the plankton if a pond dries up? How do plankton reach a new body of water.

Experiment 14: Field Experiment

Level: Junior and Senior High

Purpose: After marking off a plot of land for detailed field study, to assess its plant cover and determine if it is dominated by upland or wetland plants.
(NOTE: A, B, and C may be done individually or one following the other.)

Tools:

A. Line Transect
- Heavy string (50-100 feet or so)
- Two wooden pegs
- Fluorescent plastic surveyor's tape

B. Belt Transect
- Heavy string (at least twice the amount used in A)
- Four wooden pegs
- Paper, pencil and clipboard

C. A Plot Grid
- Four pieces of 1" x 1" x 1 meter lathe (note: 1x2 lathe will do)
- Heavy string
- Nails
- Glue
- Small drill

D. All
- Field guides to help identify plants and animals

Procedure: Note: for each of these activities, it will be more interesting if the area to be sampled extends inland from a lake, pond, or stream.

A. Line Transect
- Stretch the string between two pegs at the selected site.
- At regular intervals, tie the surveyor's tape to the string.
- Count the number of each type of plant that touches the string to determine the dominant vegetation at the area.
- At each ribbon, collect samples of the plants, or the soil for later study and identification in the classroom.
- You could run several parallel transects to obtain a more accurate assessment of the plant cover at a site. Or, you could use experiment B.

B. Belt Transect
- Mark out a narrow strip with pegs placed to form a rectangle.
- Tie and run a string from each peg, enclosing the rectangle.
- Draw a map of the area, using different symbols to indicate dominant vegetation, and vegetation zones.
- Inside the belt transect, follow the procedure in experiment C for a detailed assessment of the plant cover.

C. Plot Grid

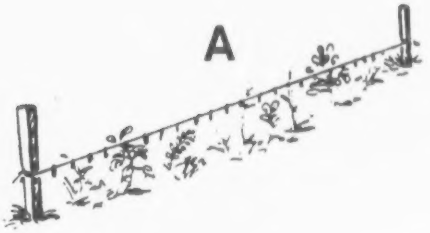
- Build a one-meter square frame from the pieces of lathe, nailing and glueing the corners securely.
- Drill three holes spaced evenly along each side of the frame.
- Weave the string through the holes (see illustration).
- Within your belt transect (see B) or on another plot, lay the grid on the ground. Count the total number of each kind of plant in each square and determine the relative dominance of each.
- Move the frame to an adjoining plot and repeat. Do this until you have completely sampled the chosen plot.

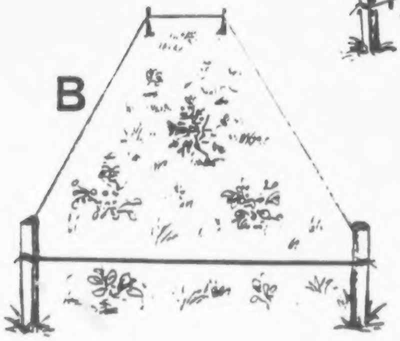
Results and Discussion:

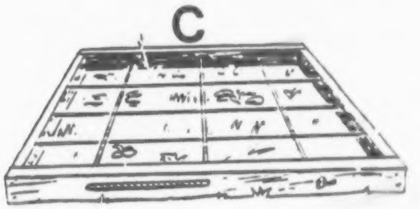
For each experiment, prepare a list of the kinds of plants in the sampling area, using the fieldbook. After the plants have been identified, determine whether the area is a wetland, a transitional zone between wetlands and uplands, or an upland. (The plant identification guide may indicate the habitat preferred by each species, or you may wish to consult other references [see appendix.]) Which method of sampling provides the most detailed picture of the area being sampled?

Schedule a class period to consider the importance of wetlands, transitional zones, and uplands to such things as wildlife, water quality, water supply, flood and erosion control, and aesthetics. Discuss how these sampling procedures might be used by planners to plan land uses which will have the least adverse effects, or by regulators to ensure that valuable resources are protected.

This is an area which teachers may wish to bring in outside "experts" to help the class discussions. Sources include DER District Offices, city and county planning and environmental offices, and local offices of any of the other agencies listed in the appendix.







TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME: Pshaun Hopkins

INTERNSHIP: Tenneco Gas
Houston, Texas

SCHOOL: Francis Scott Key Middle School
Houston, Texas

PRIMARY SUBJECT: Computer Literacy

ACTIVITIES:
- To have students explore TENET and Internet
- Have students experience on-line information systems

SUMMARY: See Attached

RESOURCES: See Attached

TTIP

CURRICULUM IMPLEMENTATION PLAN

Abstract

Explore the Internet

NAME: Pshaun Hopkins

INTERNSHIP: Tenneco Gas

SCHOOL: Francis Scott Key
Middle School, Houston

PRIMARY SUBJECT: Computer Literacy

ACTIVITIES:

- Teacher introduces students to the use of personal computers to access information services.
- Teacher introduces to students how to use the Internet and/or TENET, the Texas Educators Network. (TENET is available to Texas educators through direct dial-up.)
- Students will explore the Kids K-12Net, (KidsNet is a service designed to foster international networking between children agees 10-15 in more than 25 countries).
- Students get experience using an on-line information system, by accessing four different types of connections 1) electronic mail, 2) computer conferencing, 3) interactive Telnet sessions, and 4) non-interactive file transfer (FTP) sessions.

SUMMARY:

This teaching unit is designed to introduce students to the use of personal computers to access information services though the Internet. Students will learn the terms associated with using the Internet. Once familiar with telecommunication terms and signing on procedures, the students will be able to work as a team, get hands on experiences using the online network, retrieve e-mail, read the bulletin board, transfer information from online to PC or from PC to online and computer conferencing. In completing these activities, students will be exposed to oral communication skills, problem solving skills, critical-thinking skills, and collaboration with working in groups skills. These exercises will be useful for interdisciplinary learning as students will be able to apply what they learn in using the technology in their other subjects. Students will be able to access information from the Internet, but will also be able to take the information, organize it and present it graphically.

RESOURCES:

Tenneco, Inc.
Mrs. Susan Yancey
Corporate Librarian
P. O. Box 2511
Houston, TX 77252-2511

Tenneco, Inc.
Ms. Patricia Hintzel
Project Manager
P. O. Box 2511
Houston, TX 77252-2511

Tenneco Gas
Mr. Barry G. Morris
Senior Staff Analyst
P. O. Box 2511
Houston, TX 77252-2511

Elmer-Dewitt, Philip. "Battle for the Soul of the Internet", TIME, July 25, 1994. pp. 50-56.

Harris, Judi. "Using Internet Know-How to Plan How Students Will Know": Mining the Internet, THE COMPUTING TEACHER, May, 1993. pp. 35-39.

Harris, Judi. "Electronic Treasures by Electronic Mail", THE COMPUTING TEACHER, August/September 1992. pp. 36-38.

Harris, Judi. "Telnet Sessions on the Internet", THE COMPUTING TEACHER, October 1992. pp. 40-43.

Krol, Ed. THE WHOLE INTERNET USER'S GUIDE AND CATALOG.

Wiseman, Paul. "Businesses logon to Internet's captive computer audience"; THE HOUSTON POST, Monday, July 11, 1994, p. E-10.

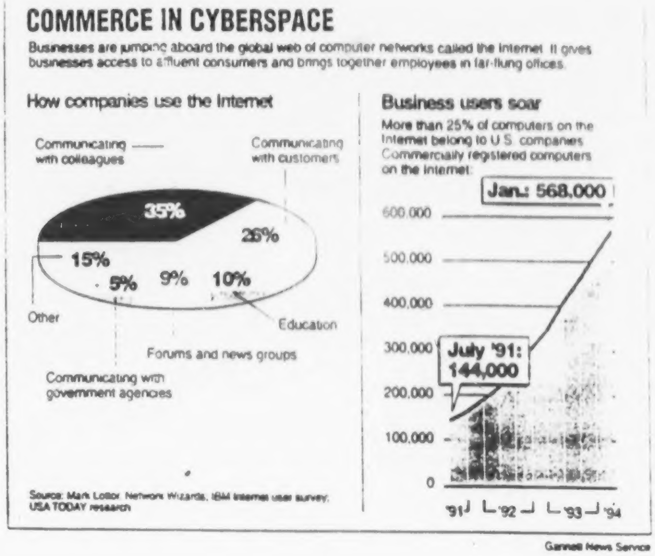
Zen and the Art of the Internet, "A Beginner's Guide to the Internet"

OVERVIEW:

I was invited to attend a network meeting with the Corporate Librarian and the Environmental Project Manager at Tenneco Inc., to explore how the Internet will be useful conducting research on environmental issues. The librarian stated that the Internet is primarily used to do research for the employees on natural gas issues, legal issues, on-line databases, bulletin board systems and access to other libraries. Businesses are climbing aboard rapidly but are not prepared to have all their employees use the Internet. Recent statistics show that there are about 30,000 computer networks, at least 2.2 million computers and 20 million people in more than 70 countries that use the Internet. Entering into cyberspace allows you to tap into thousands of databases and chat worldwide with others who are experts on specific subjects.

The Internet was established by the Defense Department in 1969 to connect the Pentagon with defense researchers in academia and business in the event a nuclear attack occurred and wiped out everything. In 1986, the National Science Foundation spurred nondefense use of the Internet by creating a special network called NSFnet. Universities nationwide started using the Internet which caused an explosion of academic use. By the late 1980's students at universities got access to the Internet when they enrolled for classes. The educational use on the Internet is small (10%) as compared to other uses of communicating with colleagues and customers, and government agencies.

Exhibit A



COMMERCE IN CYBERSPACE

Businesses are jumping aboard the global web of computer networks called the Internet. It gives businesses access to affluent consumers and brings together employees in far-flung offices.

Source: Mark Lottor, Network Wizards, IBM Internet user survey; USA TODAY research

Gannett News Service

Use of the Internet for Environmental information has not been established at Tenneco at the time of this writing. However, they are meeting more and more to discuss how they will start. We learned that the U.S. Environmental Protection Agency (EPA) has set up an electronic mini bulletin board that will allow volunteer monitors to communicate with each other via computer.

OBJECTIVES:

1. The students will understand the telecommunication terminology.
2. The students will demonstrate the ability to logon to the Internet.
3. The students will learn how to personalize their sign-on and signature line for online messages.
4. The students will learn how to retrieve and send electronic mail.
5. The student will learn how to post a question online to other students, how to review and respond to other student's writings, gather information, compile the information, and display it graphically using presentation software (interactive Telnet sessions).

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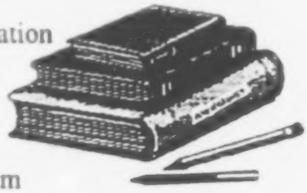
6. The student will learn what are non-interactive file transfers and how to conduct a FTP session.

Time Period: The following activities are designed for a two-week lesson.

ACTIVITY 1: Students will show their understanding of the terminology by competing against each other with questions, spellings, and definitions.

Objectives 1, 2 Oral communication skills, problem solving skills, collaboration



Terminology:

telecommunication
telephone lines
digital
e-mail
online information service
parity
dial-up connection
computer
protocol
analog
password
odd parity
Gopher, Archie, WAIS
FTP
modem
baud rate
electronic bulletin board
communication channel
even parity
gateway
ASCII/binary

There will be two teams, Team 1 will be asked to spell and define a telecommunication term. Five (5) points will be given for the correct spelling and 5 points for the definition will be awarded. If the student in succession can not spell or define the term, the next student in succession from Team 2 will be asked to take over, if the answer is correct, Team 2 will receive the points. If not, Team 1 will get another chance.

At the end, the Team with the most points will win. The winner will be the first group of students to go to the teacher station to go online. Other student workstations (not networked) will be using a simulated online information service.

ACTIVITY 2: Students will learn how to personalize their sign-on/off when sending electronic mail on the Internet and how to use pictograms to further add meaning or intent.

Objectives 3, 4 Problem solving skills.

1. Go to main menu on the Internet or in Tenet, according to the online net you are using.
2. Look for the customization menu and select.
3. Follow the instructions for creating a signature file. e.g. user name, electronic address and extension, Exhibit B.
4. Use * (asterisks) around your name to box in and set off.

```
PRH@tenet.edu                  \ :/    : /
Key Middle School - Houston      -      -
                                \  **  /
                                   v
****************************************
```

5. Use pictograms to further customize your signature, set the tone ,or to express emotion in the text. Objective 3, Remember, don't use all capitals in your text. It appears as though you are shouting.

:-) (smiley), :((madmax), 8>) (Mr. Peabody),

;-) (winky), :- {0 (astonishment John), or

8 (:-) (Mickey mouse).

6. When sending e-mail, go to main menu. Exhibit C.
7. Select send mail.
8. Enter the electronic address.
9. Enter the subject of your message.
10. You will be given the option to send additional copies to several people, by typing their addresses in response to the "Copies to:" prompt. Be sure to separate each electronic address with a space.
11. Writing a new message is similar to replying to a message except that you will need to know the address of the person you wish to send the new message. (When you are replying to a message, the electronic address of that person is already known and will appear at the top of your screen). If you do not know the address of the person you are sending a message, you can locate their address in the User Information menu. Exhibit D.

ACTIVITY 3: Students will learn to subscribe and post on the Internet (interactive), gather information from a database and display it using presentation software. Objective 5 problem solving skills, critical thinking skills, collaboration. Exhibits E and F.

Each team is to choose a topic to research on the Internet. Get enough information to be able to compile a report using presentation software. (Suggested topics : The production of electricity has become an environmental concern for our society--Should the power industry be unregulated? (Exhibit G), Who are the customers who request the use of electricity and how much do they use? (Exhibit H), What are the fuel sources to supply power needs in our society?

(Exhibit I). (This activity could be structured so that each team will get information on one main topic and divide into various subtopics.)

1. Access the main menu and choose newsgroups.
2. Scroll through the list for the news or item of interest selected by your team.
3. Select "s" for the subscription(s) you want to start receiving.
4. The next time you log on, your subscriptions should appear.
5. Post your topic interest online and ask if anyone would like to join you in the study.
6. When others begin to read your message, it is very likely they will reply, thus, the approach to studying and sharing information with cooperating classes on the Internet begins. This is called computer conferencing.
7. To post a reply, select "r" make your comments.
8. The menu will prompt you to make a selection to finalize your comments, e.g. "p" for post.

"Electronic discussion groups and/or computer conferencing are the most powerful teaching/learning tools that are available on the Internet. With them , information is more than electronically accessible; it is created and shared in an internationally cooperative context."

ACTIVITY 4: Recognizing noninteractive transfers and how to FTP. Objective 6 problem solving skills, critical-thinking skills.

1. To access and copy large files of information from remotely-located computers is the noninteractive session. A noninteractive session acquires full-text versions of books, historical information, legal, or technical documents. On an Internet site called Project Gutenberg, a not-for-profit effort, that has as its goal to have 10,000 "electronic books" available online by the year 2001, it offers: children's books, books for older children and adults, historical documents, popular poetry, and other reference materials.
2. Have students discuss among their group members what information they would like to access from the Internet on a topic (the topic may be assigned by the computer teacher or a topic used could be a part of interdisciplinary learning in which students search for information another teacher has requested.)
3. To download a file e. g. named "C", enter Send C.TXT.
4. At the prompt, enter Receive.
5. A menu will appear indicating the start of the file transfer. When the file transfer is complete, a termination message will appear, along with a system beep. The C.TXT file can now be found in the directory where the software you are using is located.
6. At the PC level enter set Default a:\NEWDIR or cd a:\NEWDIR.

7. If the file being downloaded is a binary file, at the mainframe level, enter SET FILE TYPE BINARY (NUMBERS). If the file type is ASCII (TEXT) enter SET FILE TYPE ASCII.

8. After the file type is complete, enter C. This will return the screen to the mainframe command level.

9. To <u>upload</u> a file enter RECEIVE.

10. Go to the PC level to upload the file to the mainframe, enter SEND C. TXT.

11. When the file transfer is complete, a termination message will appear along with a system beep. The C.TXT file has been uploaded into the current directory of the mainframe account. After the file type is complete enter C.

EXHIBITS

Exhibit B Source: Electronic mail from Class Internet Access

```
Date: Thu, 11 Aug 1994 08:27:18 -0700
From: RUTKOWSKI EDWARD  <LAWCHQ@orion.depaul.edu>
To: Multiple recipients of list <law-lib@ucdavis.edu>
Subject: phone # for Australian Law Librarian's Group needed

To any kind person with a fatter Rolodex than I (or an Int'l Encyclopedia of
Associations (or who lives in Australia)):

One of our non-wired members needs the phone # for the Australian Law
Librarian's Group (ALLG).  I have the address but not the phone.
If anyone has it near their fingertips, please pass it along to me.
Your assistance will be greatly appreciated.

                                   __| |__
                                  /  | |  \
                                 /   | |   \      lawchq@orion.depaul.edu
         Edward Rutkowski      /__/ ¯| |¯ \__\     312/939-4764 ext. 25
                               ______| |______      312/431-1097 fax
                             /_______| |_______\

                      American Association of Law Libraries
```

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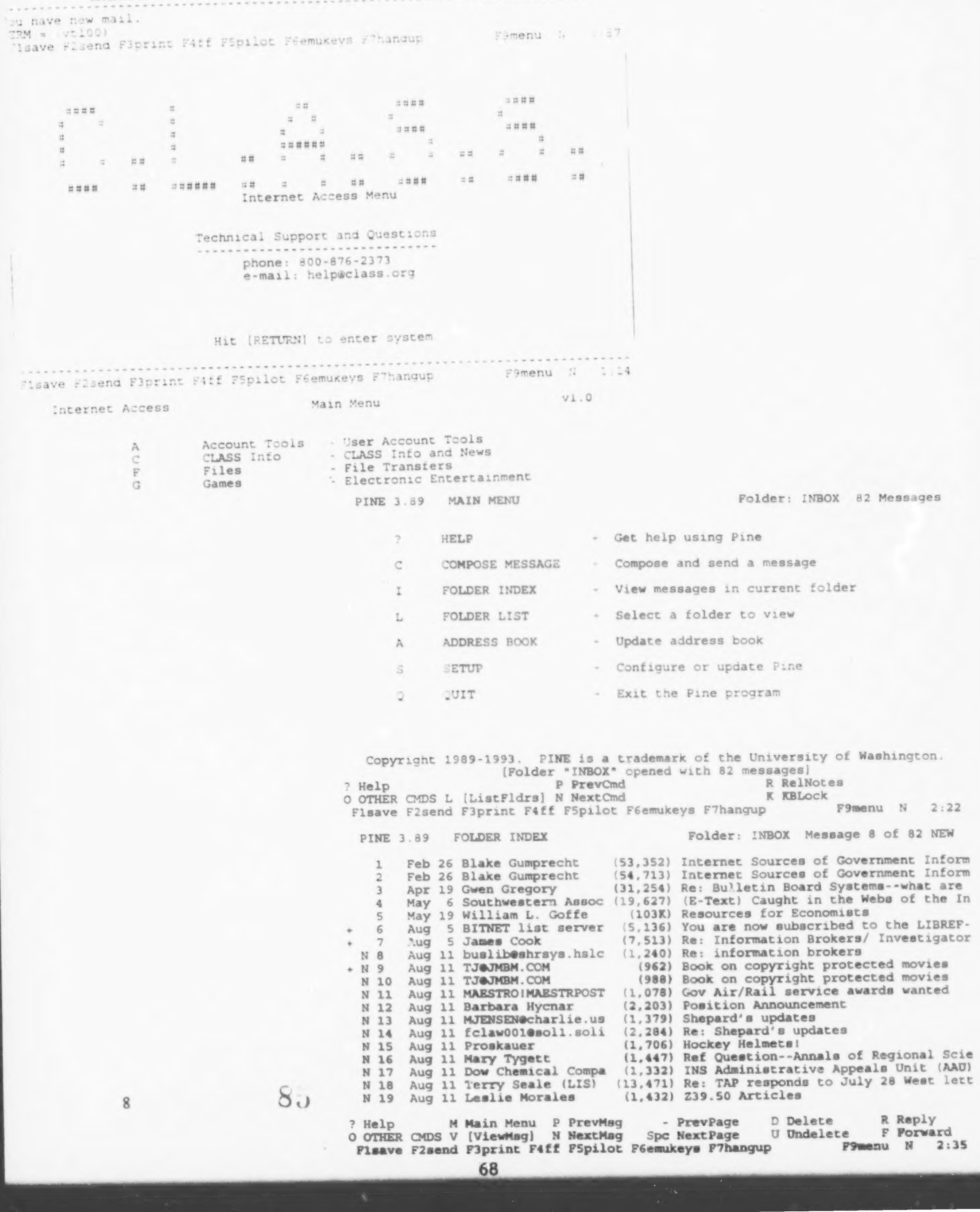
Exhibit C Source: Main Menu Class Internet Access



```
------------------------------------------------------------------------------------
ou nave new mail.
ERM = (vt100)
lsave F2send F3print F4ff F5pilot F6emukeys F7hangup          F9menu  N   :57

    ####         #            ##          ####        ####
   #    #        #           #  #        #           #
   #             #          #    #        ####        ####
   #             #          ######            #           #
   #    #   ##   #      ##  #    #   ##  #    #   ##  #    #   ##

    ####    ##   ######  ##  #    #   ##   ####   ##   ####    ##
                        Internet Access Menu

                     Technical Support and Questions
                     -------------------------------
                          phone: 800-876-2373
                          e-mail: help@class.org


                      Hit [RETURN] to enter system
------------------------------------------------------------------------------------
F1save F2send F3print F4ff F5pilot F6emukeys F7hangup          F9menu  N   1:24

   Internet Access                    Main Menu                    v1.0

           A        Account Tools    - User Account Tools
           C        CLASS Info       - CLASS Info and News
           F        Files            - File Transfers
           G        Games            - Electronic Entertainment
```

```
    PINE 3.89   MAIN MENU                            Folder: INBOX  82 Messages

             ?     HELP               -  Get help using Pine

             C     COMPOSE MESSAGE    -  Compose and send a message

             I     FOLDER INDEX       -  View messages in current folder

             L     FOLDER LIST        -  Select a folder to view

             A     ADDRESS BOOK       -  Update address book

             S     SETUP              -  Configure or update Pine

             Q     QUIT               -  Exit the Pine program



  Copyright 1989-1993.  PINE is a trademark of the University of Washington.
                       [Folder "INBOX" opened with 82 messages]
? Help                     P PrevCmd                    R RelNotes
O OTHER CMDS L [ListFldrs] N NextCmd                    K KBLock
 F1save F2send F3print F4ff F5pilot F6emukeys F7hangup       F9menu  N   2:22
```

```
  PINE 3.89   FOLDER INDEX                     Folder: INBOX  Message 8 of 82 NEW

     1   Feb 26 Blake Gumprecht     (53,352) Internet Sources of Government Inform
     2   Feb 26 Blake Gumprecht     (54,713) Internet Sources of Government Inform
     3   Apr 19 Gwen Gregory        (31,254) Re: Bulletin Board Systems--what are
     4   May  6 Southwestern Assoc  (19,627) (E-Text) Caught in the Webs of the In
     5   May 19 William L. Goffe      (103K) Resources for Economists
 +   6   Aug  5 BITNET list server   (5,136) You are now subscribed to the LIBREF-
 +   7   Aug  5 James Cook           (7,513) Re: Information Brokers/ Investigator
   N 8   Aug 11 buslib@shrsys.hslc   (1,240) Re: information brokers
 + N 9   Aug 11 TJ@JMBM.COM            (962) Book on copyright protected movies
   N 10  Aug 11 TJ@JMBM.COM            (988) Book on copyright protected movies
   N 11  Aug 11 MAESTRO!MAESTRPOST   (1,078) Gov Air/Rail service awards wanted
   N 12  Aug 11 Barbara Hycnar       (2,203) Position Announcement
   N 13  Aug 11 MJENSEN@charlie.us   (1,379) Shepard's updates
   N 14  Aug 11 fclaw001@soll.soli   (2,284) Re: Shepard's updates
   N 15  Aug 11 Proskauer            (1,706) Hockey Helmets!
   N 16  Aug 11 Mary Tygett          (1,447) Ref Question--Annals of Regional Scie
   N 17  Aug 11 Dow Chemical Compa   (1,332) INS Administrative Appeals Unit (AAU)
   N 18  Aug 11 Terry Seale (LIS)   (13,471) Re: TAP responds to July 28 West lett
   N 19  Aug 11 Leslie Morales       (1,432) Z39.50 Articles

? Help           M Main Menu  P PrevMsg     - PrevPage   D Delete     R Reply
O OTHER CMDS V [ViewMsg]      N NextMsg   Spc NextPage   U Undelete   F Forward
 F1save F2send F3print F4ff F5pilot F6emukeys F7hangup          F9menu  N   2:35
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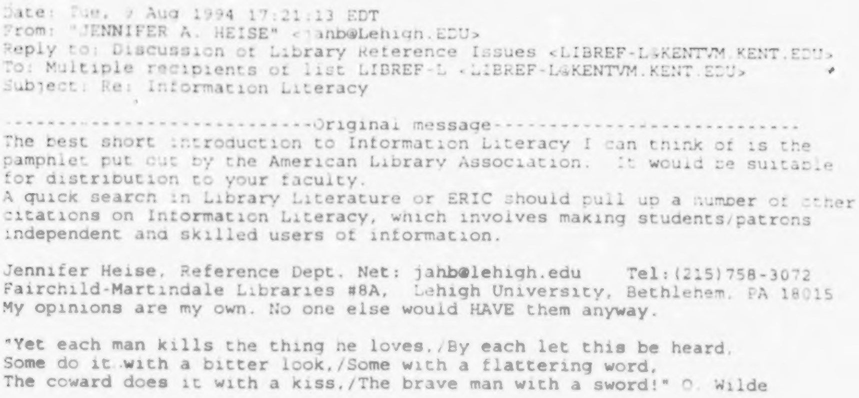
8

85

Exhibit D Source: Electronic Mail Internet



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Date: Tue, 9 Aug 1994 17:21:13 EDT
From: "JENNIFER A. HEISE" <janb@Lehigh.EDU>
Reply to: Discussion of Library Reference Issues <LIBREF-L&KENTVM.KENT.EDU>
To: Multiple recipients of list LIBREF-L <LIBREF-L&KENTVM.KENT.EDU>
Subject: Re: Information Literacy

-----------------------------Original message----------------------------
The best short introduction to Information Literacy I can think of is the
pamphlet put out by the American Library Association.  It would be suitable
for distribution to your faculty.
A quick search in Library Literature or ERIC should pull up a number of other
citations on Information Literacy, which involves making students/patrons
independent and skilled users of information.

Jennifer Heise, Reference Dept. Net: janb@lehigh.edu    Tel:(215)758-3072
Fairchild-Martindale Libraries #8A,  Lehigh University, Bethlehem, PA 18015
My opinions are my own. No one else would HAVE them anyway.

"Yet each man kills the thing he loves,/By each let this be heard,
Some do it with a bitter look,/Some with a flattering word,
The coward does it with a kiss,/The brave man with a sword!" O. Wilde
```
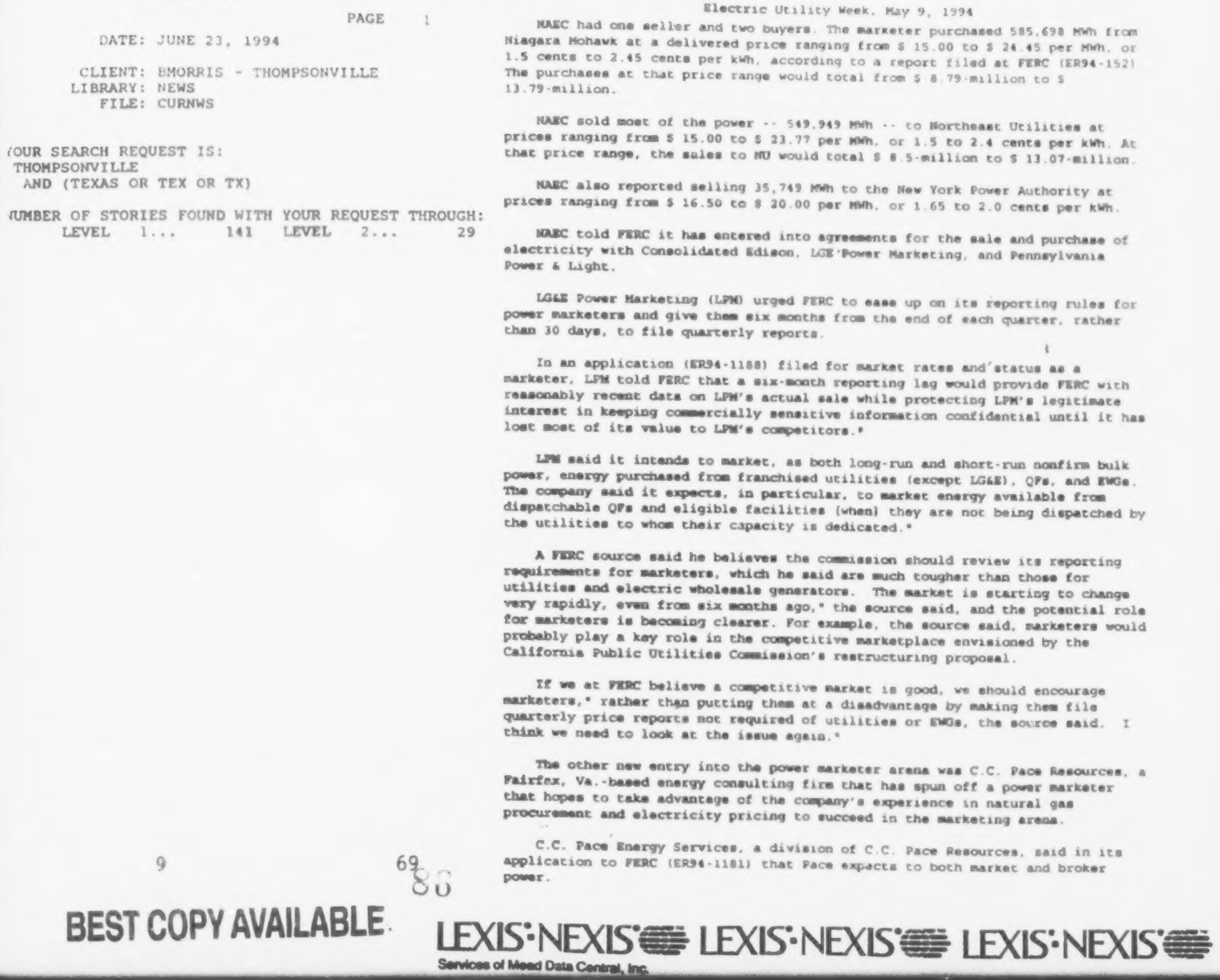

Exhibits E Source: Lexis/Nexis Lexis 2000 Research Software



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                          PAGE    1
     DATE: JUNE 23, 1994

   CLIENT: BMORRIS - THOMPSONVILLE
  LIBRARY: NEWS
     FILE: CURNWS

YOUR SEARCH REQUEST IS:
 THOMPSONVILLE
  AND (TEXAS OR TEX OR TX)

NUMBER OF STORIES FOUND WITH YOUR REQUEST THROUGH:
     LEVEL   1...      141   LEVEL   2...       29
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Electric Utility Week, May 9, 1994

NAEC had one seller and two buyers. The marketer purchased 585,698 MWh from Niagara Mohawk at a delivered price ranging from $ 15.00 to $ 24.45 per MWh, or 1.5 cents to 2.45 cents per kWh, according to a report filed at FERC (ER94-152) The purchases at that price range would total from $ 8.79-million to $ 13.79-million.

NAEC sold most of the power -- 549,949 MWh -- to Northeast Utilities at prices ranging from $ 15.00 to $ 23.77 per MWh, or 1.5 to 2.4 cents per kWh. At that price range, the sales to NU would total $ 8.5-million to $ 13.07-million.

NAEC also reported selling 35,749 MWh to the New York Power Authority at prices ranging from $ 16.50 to $ 20.00 per MWh, or 1.65 to 2.0 cents per kWh.

NAEC told FERC it has entered into agreements for the sale and purchase of electricity with Consolidated Edison, LGE Power Marketing, and Pennsylvania Power & Light.

LG&E Power Marketing (LPM) urged FERC to ease up on its reporting rules for power marketers and give them six months from the end of each quarter, rather than 30 days, to file quarterly reports.

In an application (ER94-1188) filed for market rates and status as a marketer, LPM told FERC that a six-month reporting lag would provide FERC with reasonably recent data on LPM's actual sale while protecting LPM's legitimate interest in keeping commercially sensitive information confidential until it has lost most of its value to LPM's competitors."

LPM said it intends to market, as both long-run and short-run nonfirm bulk power, energy purchased from franchised utilities (except LG&E), QFs, and EWGs. The company said it expects, in particular, to market energy available from dispatchable QFs and eligible facilities (when) they are not being dispatched by the utilities to whom their capacity is dedicated."

A FERC source said he believes the commission should review its reporting requirements for marketers, which he said are much tougher than those for utilities and electric wholesale generators. The market is starting to change very rapidly, even from six months ago," the source said, and the potential role for marketers is becoming clearer. For example, the source said, marketers would probably play a key role in the competitive marketplace envisioned by the California Public Utilities Commission's restructuring proposal.

If we at FERC believe a competitive market is good, we should encourage marketers," rather than putting them at a disadvantage by making them file quarterly price reports not required of utilities or EWGs, the source said. I think we need to look at the issue again."

The other new entry into the power marketer arena was C.C. Pace Resources, a Fairfax, Va.-based energy consulting firm that has spun off a power marketer that hopes to take advantage of the company's experience in natural gas procurement and electricity pricing to succeed in the marketing arena.

C.C. Pace Energy Services, a division of C.C. Pace Resources, said in its application to FERC (ER94-1181) that Pace expects to both market and broker power.

9

LEXIS·NEXIS LEXIS·NEXIS LEXIS·NEXIS
Services of Mead Data Central, Inc.

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Exhibit F- Source: Harvard Business Review September-October 1990

FTP

The U.S. deregulated trains, planes, and more. EC'92 can learn from the experience.

Strategic Choices for Newly Opened Markets

by Joel A. Bleeke

As 1992 approaches, markets are opening not just in Western Europe but throughout the world. In Eastern Europe, Asia, and North America, trade walls that have stood for decades are beginning to crumble in the face of political unrest and technological innovation. In anticipation of these changes, a do-or-die atmosphere is driving many European, Japanese, and U.S. companies to become broad-based competitors. And in the deal-oriented atmosphere that has ensued, aggressive competitors are often forced to make critical decisions fast on whether and how to expand into uncharted terrain.

Fortunately, a valuable map is available: U.S. companies' experience with deregulation over the past ten years. That experience shows clearly the pattern of competitive dynamics that unfolds when artificial constraints are suddenly lifted and new entrants are allowed to rush in. Consequently, it provides useful lessons not only for markets opening because of regulatory changes but also for markets such as telecommunications, semiconductors, and autos, which are becoming global in response to technological or other discontinuities.

Perhaps the most important of these lessons has to do with time. The U.S. companies' experience shows that managers who look only to the years immediately surrounding 1992 – or any other market opening – will make irreparable mistakes. Because the competitive environment changes twice – once when the market opens and again about five years later – a ten-year roadmap is essential.

This road map will direct many large competitors away from their traditional roles as broad-line players into new, more profitable roles as low-cost entrants, focused-segment marketers, or providers of shared utilities. And for many, the map will include acquisition activity that has already begun, allowing less time for managers to think through their long-term game plans. Indeed, the strong alliances that are already forming across Europe suggest that the competitive situation may soon be dominated by powerful, broad-based competitors holding a series of local oligopolies and making new entry extremely difficult and costly.

> The opening of Europe may be even more traumatic than U.S. deregulation.

> In deregulated markets, nearly all new entrants fail. So do many large competitors.

Despite the differences, the U.S. experience with deregulation shows how the opening of once restricted markets leads to a new competitive world. Whether the market is in Canada, Eastern Europe, Asia, or the European Community matters less than the competitive dynamic its opening unleashes. And in that competitive dynamic, undifferentiated size matters less than the strategic choices thoughtful managers make.

The Competitive Dynamics of Deregulation

Deregulation in the United States began in 1975, when the SEC abolished fixed rates for U.S. securities brokers. Before long, other industries were coping with deregulation as well: airlines in 1978, trucking and railroads in 1980, banking and telecommunications at intervals throughout the 1980s. In every instance, we can see the same set of competitive dynamics play itself out.

☐ While the number of new entrants can be staggering, nearly all soon fail – along with many large existing competitors. No fewer than 215 new air carriers entered the market in the ten years following deregulation, compared with *no* new FAA-certified carriers in the preceding 40 years. But fewer than one-third of the new entrants and fewer than half (44%) of the existing competitors survived those ten years as independent entities. Arguably, only two of the new carriers (Midway Airlines and America West Airlines) have distinctive strong franchises today (and even Midway is suffering financially as a result of recent expansion beyond its Chicago hub). In trucking the story was much the same. From a steady level of 17,000 truckers in the 1960s and 1970s, the number of competitors rose to over 37,000 in 1987. At the same time, more than 72 companies, accounting for over $2 billion or 16% of industry revenues, shut down between 1980 and 1982 alone.

☐ Industry profitability deteriorates rapidly as new entrants shatter pricing for all competitors for at least five years. The surprise is not entrants' starkly lower costs. (On average these were 40% to 50% below competitors' chiefly because the new companies carried less baggage such as seniority agreements, outmoded factories, and expensive distribution systems.) The surprise is new entrants' ability to destroy market pricing for everyone, even if they take only 10% to 15% of total market share. In the securities industry, for example, discount brokers captured less than 20% of consumer volume, but they forced a 30% reduction in market prices. Prices in the central-office and PBX-switching markets fell by 40% to 50%, yet low-cost entrants captured no more than 25% of the total market share.

☐ The most attractive business segments often become the least attractive – and vice versa – as competitors all flock to the same markets and cross-

Joel A. Bleeke is a director of McKinsey & Company and co-leader of McKinsey's International Management Center.

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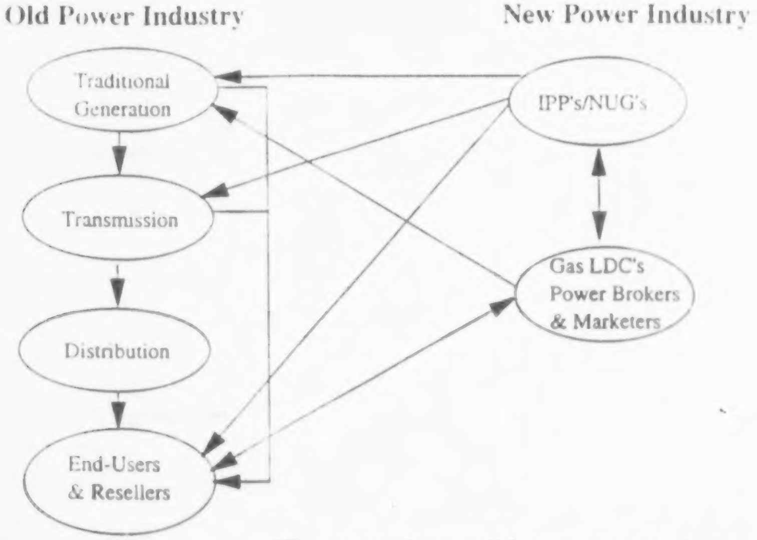
Exhibit G Source: The Rudden Resource - June 1994

The Changing Power Industry

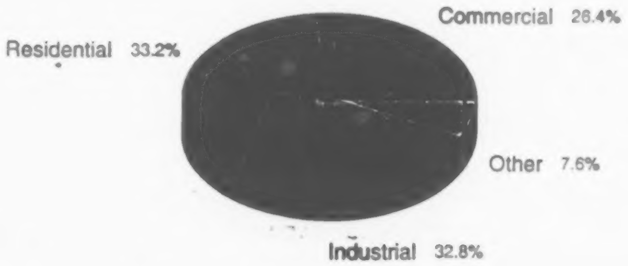

Old Power Industry
New Power Industry
Traditional Generation
Transmission
Distribution
End-Users & Resellers
IPP's/NUG's
Gas LDC's Power Brokers & Marketers

"Future markets will be composed of unregulated profit seekers and arbitrageurs seeking opportunities and making decisions based on pure economics."

Electricity Study

1993 Electricity Demand by Sector

Exhibit H



As a % of U.S. KWh Sales
Source: United States Department of Energy

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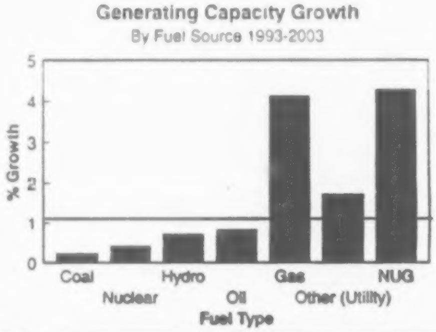
Exhibit I Source: NERC (North American Electricity Reliability Council) Supply and Demand Pamphlet June, 1994
(NUG'S - non utility generators IPP- independent power producers)

Supply (Capacity)

- Growth of Generating Capacity
  - Peaking Needs & NUG's/IPP's
- Winners.
  - low cost producers with surplus capacity
  - those with strategically located transmision systems


Generating Capacity Growth
By Fuel Source 1993-2003

Electricity Study

CONCLUSION:

The opportunity to meet with the professionals on this subject has helped me to recognize that our students should spend ample time studying about the Internet. They should be familiar with all the terms associated with telecommunications and learn to enter the world of information electronically. The students' next mission once they have entered the Internet is to obtain the information, they will need to know in order to meet cooperatively, determine through discussions what is important, compile the information, and as a final task, to display that information graphically.

My entire experience working in industry this summer, attending the meetings, and participating and assisting with the preparation of presentations using Freelance graphics was most valuable. There were huge efforts of team work among the employees to complete a project or study. The problem solving involved when using the most recent technology to prepare these presentations, was a great experience that would not have occurred in the classroom. As a result, I have grown professionally and will be forever appreciative to Tenneco Gas, my Mentor Barry Morris, the Technology Specialist, Carole Thurston, their boss Randy Thompson, Vice President Strategic Planning, and all the other Tenneco employees who had jobs to do and invited me along for the adventure . Thanks to Texas A&M for spearheading this exciting experience and exposure in the business world.

The internship experience makes a teacher's role in education a much less isolated endeavor. It is also much more meaningful because it links students, teachers, scientists, authors, and people from all walks of life together in collaboration with one another. I will be able to take what I have learned back to the classroom and encourage students to choose a high level curriculum that will provide a high level of skills and readiness for the work force and/or college.

TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME: Mark W. Briles

INTERNSHIP: Texas A&M University
Biochemistry/Biophysics
College Station, Texas

SCHOOL: Bremond High School
Bremond, Texas

PRIMARY SUBJECT: Biology

ACTIVITIES:

- Making cell media
- Sterilizing and sterile techniques
- Growing bacteria for scientific study
- Estimating population of bacteria
- Enculating technoques

SUMMARY: The student will be able to demonstrate proper technique when working in a biological research laboratory. Focus on skills such as: sterile technique, the use of incubators and autoclaves, and how to improvise and create a "home-made" mini-lab using inexpensive materials found at home to replace autoclaves and incubators.

RESOURCES: See Attached.

NAME: Mark W. Briles

INTERNSHIP: Texas A&M University, Biochemistry/Biophysics

SCHOOL: Bremond High School

PRIMARY SUBJECT: Biology

ACTIVITIES:
* Making cell media
* Sterilizing and sterile techniques
* Growing bacteria for scientific study
* Estimating population of bacteria
* Enoculating techniques

SUMMARY: The student will be able to demonstrate proper technique when working in a biological research laboratory. We will focus on skills such as: sterile technique, the use of incubators and autoclaves, and how to improvise and create a "home-made" mini-lab using inexpensive materials found at home to replace autoclaves and incubators. A field trip to the biochemistry department at Texas A&M will suppliment these activities and provide an opportunity for the students to do interviews concerning biochemistry as a potential career.

RESOURCES: Texas A&M Biochemistry and Biophysics Department
Dr. Ed Funkhouser, Associate Head of Undergraduate Education
Dr. Jim Hu, Associate Professor

Texas Alliance for Science, Technology, and Mathematics Education, TAMU, Dr. Robert K. James, Director, Brian T. Walenta, Project Coordinator.

Texas Teacher Internship Program CIP Publication, 1993

Basic Microbiology, sixth addition, Wesley A. Volk/Margret F. Wheeler, Harper & Row, Publishers, Inc., 1988.

Laboratory Manual, Basic Mirobiology, sixth addition, Wesley A. Volk/Margret F. Wheeler, Harper & Row, Publishers, Inc. 1988.

CURRICULUM IMPLEMENTATION PLAN

TEACHER: Mark Briles

Mentor: Dr. Jim Hu, Biochemistry & Biophysics, TAMU

Goal: To familiarize students with scientific experimentation concerning DNA and protein synthesis and create interest in science as a potential career.

OBJECTIVES:

1. Student will be able to make an agar plate from a recipe.
2. Student will enoculate a bacteria cell culture on to an agar media using sterile and safe techniques.
3. Student will demonstrate the correct procedure for determining the amount of bacterial contamination in a given sample of food.
4. Student will describe five careers related to biochemistry.
5. Student will demonstrate proper sterile techniques when working in a biochemistry lab.
6. Students will demonstrate the ability to function as a lab team each with an equal responsibility to the experiment's conclusion.

CURRICULUM IMPLEMENTATION PLAN

ACTIVITIES: page 1

1. MAKING NUTRIENT AGAR (NA)

MATERIALS:

Dehydratated nutrient agar, 600 ml beaker, triple-beam balance, ring stand, bunsen burner, matches, petri dishes, tongs, baby food jars.

A) Weigh 6.9 grams dehydrated NA and pour into a 600 ml beaker(make sure beaker is large enough to prevent boiling over).

B) Measure 300 ml distilled water and pour into the beaker+agar.

C) Heat to a boil being sure to stir continuously until the solution is well mixed.

D) Remove agar solution and set aside. Place a beaker of water(100 ml) on the ring stand and boil.
Note: This step is only necessary if no autoclave is available. There will be a small amount of contamination and students should be taught the difference between autoclaving and sterilizing by boiling.

E) Pour agar solution from step C into a baby food jar(lid off).

F) Place the agar+jar into the boiling water bath to sterilize.
Note: Dip the tongs quickly into the hot water to sterilize before touching the jar's inner edge.

G) After 10 minutes, remove the jar (sterilize tongs) with the tongs by gripping the jar lip and place on a heat resistant pad. Quickly grip the outside of the jar and pour into a sterile glass petri dish(just enough to cover the bottom of the dish). There should be enough agar to pour 3 dishes.
Note: You can sterilize petri dishes in boiling water or by oven drying(home economics room).

H) Allow the agar to solidify for 15 minutes.
Note: Students should be reminded of all safety rules when using glass, and using the bunsen burner.

OBJECTIVES COVERED: 1, 5, & 6
ELEMENTS COVERED : Teamwork, Critical thinking, Safety

2. Enoculate A Media With A Cell Culture

MATERIALS:

Prepared agar in petri dishes, dry air oven, incubator(or space heater), enoculating loops, paper, pencil, wax pencils, compass.

A) Place clean petri dishes in a dry air oven for 15 minutes at 350 degee F (180 C) to sterilize.
Note: Students should be tought the difference between autoclaving and using the dry air oven.

B) Follow steps for making NA in activity 1 of this publication.

C) Before enoculating cells, have students practice the following procedure:

1) On a plain sheet of paper, draw a circle 3 inches in diameter. Line and lable as in Figure 14-2(see appendix 1)
Note: 0 sector is smaller.
2) Begin Figure14-3. Using your pencil, draw solid lines in sector 0.
3) Study Figure 14-4 and then draw lines from sector 0 into sector I as shown.
4) Rotate your paper counterclockwise one quarter turn so that sector I is on the left.
5) Draw streak lines as shown in Figure 14-5.
6) Rotate paper again and streak sector III as shown in Figure 14-6.

D) Now continue by marking the bottom of the petri dish as demonstrated in the above procedure.

E) Always remove lid carefully as shown in Figure 14-9 using your left hand to raise the lid and the right to hold the loop(left handed persons will need to adjust accordingly).

**F) Proceed slowly through all four steps, reading the instructions as you go.
Note: Students may have trouble piercing the agar with the loop. Practice on jello(it is less expensive).**

**G) Place the enoculated dishes into the incubator at @ 73 degrees F.
Note: If you have no incubator, try clearing out a small closet space, removing all fire hazzards, and using a tip-safe, temperature controlled space heater. Be sure to use a new space heater with thermostat and automatic shut-off switch in case of a tip over. Also, make sure the closet is free from explosives, chemicals, old wooden materials, etc.**

OBJECTIVES COVERED: 2,5,& 6
ELEMENTS COVERED : Teamwork, Critical thinking, Safety

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3. Determining Numbers Of Bacteria In A Food Sample

MATERIALS: Frozen meat pie, 600 ml beaker, stirring fork, triple-beam balance, petri dish(prepared with agar), pencil, paper, calculator.

A) Weigh 10 grams of meat pie. Then add to 90 ml of distilled water.

B) Mix with a fork or blender until pie is dissolved.

C) Plate 0.1 ml onto an agar petri dish.

D) Determine the dilution factor:

Dilution factor = (D)

D = Amount transfered + Amount in beaker
- divided by -
(Amount transfered)(Amount plated)

So: D = 0.1 + 99.9 / (0.1)(0.1) = 10,000

Dilution = 10,000

E) Incubate over night.

F) Count the colonies on the over night sample. If, for example, 111 colonies grew on the plate, calculate the number of organisms per ml:

Formula:
Bo = D x C
Bo = number of bacteria in one ml
D = dilution factor
C = number of colonies counted

The meat pie dilution factor was 10,000
The number of colonies counted was 111
So: Bo = (10,000) (111) = 1,110,000 organisms/ml

OBJECTIVES COVERED: 1, 2, 3, 5, & 6
ELEMENTS COVERED : Teamwork, Problem solving, Critical thinking, Written communication.

4. Describe Five Careers Related To Biochemistry

MATERIALS: School library, professional survey(appendix 2), paper, pen.

A) Students will attend a field trip to the Biochemistry and Biophysics Department at Texas A&M University.

B) A copy of the professional survey(appendix 2) will be filled out by each student.

C) In groups of five, the students will research the types of jobs available in the field by surveying the posted job openings displayed in the various locations of the biochemistry building. They will be required to note the type of position, the job qualifications, location of job opening, and the yearly salary offered.

Note: Prior arrangements are necessary to insure the availability of the lab professionals.

OBJECTIVES COVERED: 4, 6
ELEMENTS COVERED : Oral communication, Written commnication, Career opportunities/Information, Critical thinking

APPENDIX 1

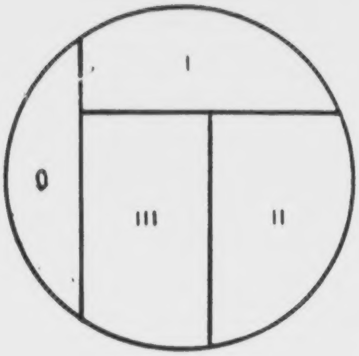


FIGURE 14-2
Dilution sectors as drawn on paper.

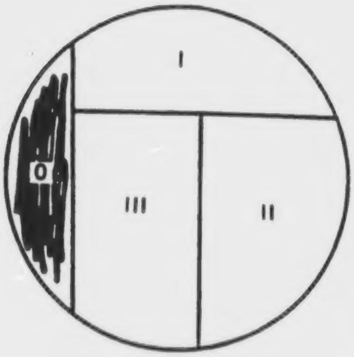


FIGURE 14-3
Step 1: Sector 0 represents the planting of a small amount of bacteria with your inoculating loop. This simulates the original inoculum.

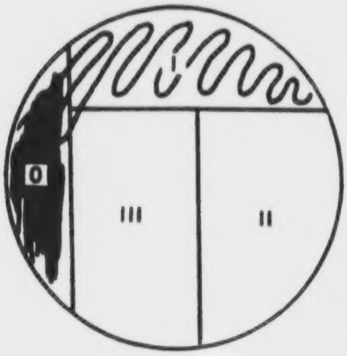


FIGURE 14-4
Step 2: Sector I represents the first dilution. Your lines in Sector I should be as uniformly apart as shown here.

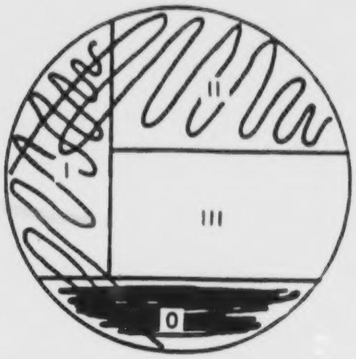


FIGURE 14-5
Step 3: Sector II represents the second dilution.

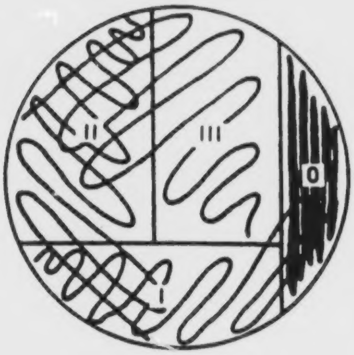


FIGURE 14-6
Step 4: Sector III represents the final dilution of the organisms. Be sure to leave some space between each sector to allow for the expanding bacterial growth.

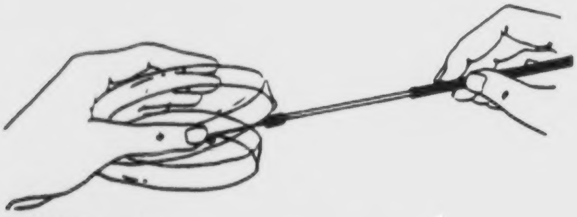


FIGURE 14-9
Proper handling of the lid of the petri dish. Open the petri dish slightly, but keep the lid over the dish. This will protect the sterile medium from airborne bacteria.

APPENDIX 2

JOB TITLE

JOB DESCRIPTION

1. What is your age range? (circle one)

20-25   26-30   31-35   36-40   41-45   46-50

51-55   56-60   over 60

2. Circle one: Male   Female

3. How long have you worked for __________ .

4. What is your annual salary range, including overtime? (circle one)

$10,000-$20,000 $20,000-$30,000 $30,000-$40,000

$40,000-$50,000 $50,000-$60,000 $60,000-$70,000

$70,000-$80,000   over $80,000

5. How is your salary determined? (circle one)

Hourly   Monthly

6. What background is required for your job?

7. What is YOUR background?

8. What are the advantages of your job?

9. What are the disadvantages of your job?

10. What opportunities are available to you on this job?

11. What personal skills or qualities are needed for your job?

12. What advice would you give a high school student?

Class Activity 1

Give students copies of the surveys.

Fill out the following charts using the surveys. Use tick marks to complete.

AGE OF EMPLOYEE

20-25 ____________

26-30 ____________

31-35 ____________

36-40 ____________

41-45 ____________

46-50 ____________

51-55 ____________

56-60 ____________

over 60 ____________

NUMBER OF YEARS

1-3 ____________

4-6 ____________

7-9 ____________

10-12 ____________

13-15 ____________

16-18 ____________

19-21 ____________

22-24 ____________

25 or more ____________

SALARY

Hourly ____________

Monthly ____________

SEX

Male ____________

Female ____________

SALARY RANGE

$10,000 - 20,000 ____________

$20,000 - 30,000 ____________

$30,000 - 40,000 ____________

$40,000 - 50,000 ____________

$50,000 - 60,000 ____________

$60,000 - 70,000 ____________

$70,000 - 80,000 ____________

over $80,000 ____________

TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME: Susana Troncoso Skidmore

INTERNSHIP: Texas A&M University
Department of Soil & Corp Science

SCHOOL: Pre-Service

PRIMARY SUBJECT: Biology

ACTIVITIES:

- How to grow Brassica
- Extracting DNA from Brassica
- Size fractionation of DNA extracted from Brassica

SUMMARY:

This lesson should provide students with the opportunity to extract DNA from a plant that is grown in the classroom and to make an agarose gel for use in electrophoresis. To do this the students must actively cooperate with their partner/partners and engage in problem solving and reflective evaluation of the procedure that they are performing. It is also my intention to inform students of some of the possible career opportunities available to them in the area of biotechnology.

RESOURCES:

Dr. Edward Funkhouser
Texas A&M University
Department of Soil and Crop Sciences

David Lan
Texas A&M University
Department of Soil and Crop Sciences

Dr. Andrew Paterson
Texas A&M University
Department of Soil and Crop Sciences

TTIP
Curriculum Implementation Plan
Abstract

Name: Susana Troncoso Skidmore

Internship: Texas A&M University: Department of Soil & Crop Science

School: Pre-service

Primary Subject: Biology

Activities:

- How to grow Brassica
- Extracting DNA from Brassica
- Size fractionation of DNA extracted from Brassica

Summary:

This lesson should provide students with the opportunity to extract DNA from a plant that is grown in the classroom and to make an agarose gel for use in electrophoresis. To do this the students must actively cooperate with their partner/partners and engage in problem solving and reflective evaluation of the procedure that they are performing. It is also my intention to inform students of some of the possible career opportunities available to them in the area of biotechnology.

Resources:

Funkhouser, Edward. (1994) Associate Head of Undergraduate Education, Agricultural and Life Sciences, Department of Biochemistry and Biophysics, Texas A&M University. College Station, TX

Lan, David. (1994) Ph.D. student in Dr. Paterson's laboratory, Department of Soil and Crop Sciences, HEEP 227, 409- 845- 2541, Texas A&M University. College Station, TX

Paterson, Andrew. (1994) Assistant Professor of Molecular Genetics, Department of Soil and Crop Sciences, HEEP 227, 409- 845- 3773, Texas A&M University. College Station, TX

Sambrook, J., Fritsch, E. F., & Maniatis, T. (1989) Molecular Cloning A Laboratory Manual Second Edition, Volume One, Cold Spring Harbor Laboratory Press, Cold Spring Harbor, New York. pp. 6.1-6.19.

THE ROAD TO MAPPING DNA

Growing Brassica:

To obtain seeds you may write or call:

Crucifer Genetics Cooperative
Department of Plant Pathology
1630 Linden Dr.
University of Wisconsin
Madison, Wisconsin
53706
(1-608-262-8638)

If you want Brassica to flower it is best to plant it in October. If it is to be kept indoors, it does not matter when it is planted, . Indoors, the plants require 12 hours of light and 12 hours of darkness. It is preferable to keep the plants indoors to prevent insects, fungi, etc. from attacking the plants. You may place a commercial fertilizer stick like Miracle-gro, if you wish, on the bottom of the pot before covering the pot with potting soil. The seeds can be placed on top of the soil and watered daily. The first week it is a good idea to cover the pot loosely with saran wrap and a rubber band to keep the moisture in. After the first week the plants can still be watered daily, just make sure you have a pot that has a hole to drain excess water. The part of the plant that is best for DNA extraction is the young leaves of the plant.

Safety in the Laboratory:

1. Always read and follow instructions carefully.

2. There is to be no horseplay in the lab.

3. The labels of all chemicals should be read carefully and any caustic or flammable substances should only be open and used under a hood or a well ventilated area.

4. When working with ethidium bromide(a carcinogen) and chloroform(an anesthetic), gloves should be worn, and extra precaution should be taken.

5. It is important to wear closed shoes in the lab, preferably leather, in case of any spills.

6. There is to be no smoking, eating or drinking in the laboratory.

7. Dispose of waste chemicals only as instructed by your teacher.

8. In the event of a spill, injury or accident, inform your teacher immediately.

9. It is preferable to not wear shorts, or short skirts, during lab.

10. It is preferable to wear safetey goggles.

Extracting DNA from Brassica:
Dr. Andrew Paterson's Procedure modified for the classroom

- Harvest about 2 g tissue (no more than 3 g) into a 50 ml tube
- For immediate use, keep on ice
- For storage, drop tube in liquid nitrogen to freeze, then store at -20°C freezer(If you do not have access to liquid nitrogen, you can just put it directly in the freezer.)

1) To homogenize tissue:
   a. Add Sodium Bisulfite (0.38 g per 100 ml) to extraction buffer.
   b. Add 30 ml cold extraction buffer to one frozen leaf sample.
   c. Homogenize (about 10,000 RPM for 20-30 seconds).
   d. Set first tube on ice.

e. Rinse homogenizer thoroughly, and repeat for next tube.(if it is the exact same tissue from the same plant /population, you do not have to rinse the homogenizer)

f. If you do not have access to a homogenizer, you could combine the class's samples into a kitchen-style blender and then aliquot the blended samples to each pair of students. If you use a blender, use a medium speed. The objective is to make it look like a green milkshake with a few particles of intact tissue remaining.

NOTE: DO NOT THROW AWAY THE REMAINDER OF YOUR EXTRACTION BUFFER YOU WILL NEED IT IN STEP 3!

2) To pellet the cell nuclei:

a. Centrifuge samples for 20 minutes at 3500 RPM.

b. A second batch can be started at this time.

3) To lyse nuclei: (See Figure 1)

a. Pour off supernatant(upper liquid layer).

b. Add 1.25 ml extraction buffer, and vortex(or shake vigorously) for 5 seconds at top speed.(Make sure you resuspend the pellet. You might have to tap the bottom of the tube on the bench top to do this. Be careful not to break the tube.)

c. Add 1.75 ml tomato nuclei lysis buffer and 0.6 ml 5% sarkosyl.

d. Cap tubes and invert gently 5-10 times to mix.

e. Incubate in a 65°C water bath for 20-25 minutes (longer or shorter can be bad).

4) To isolate and wash nuclei:

a. Add 7.5 ml CIA to each tube.

b. Cap tubes snugly, and invert gently as a group 30-40 times.

c. Centrifuge 5 minutes at 2000 RPM (or faster if the separation does not appear to be complete).

d. Use P5000(or glass pipette and rubber bulb) to pipette off supernatant into pre-labeled 15 ml Falcon tubes. Aqueous volume will usually be about 3 ml. BE VERY CAREFUL TO AVOID THE INTERFACE BETWEEN THE TWO LAYERS!

5) To precipitate DNA :

a. Add 5 ml cold Isopropanol to precipitate DNA.

b. Most samples should be hookable with a glass rod or flame sealed glass pipette- if so dip briefly in cold 70% ethanol then resuspend in 100 μl TE (for 10 min. at 65°C or overnight in refrigerator).

c. If the sample cannot be hooked - centrifuge for 20 minutes at 3500 RPM. Pour off supernatant. Add 1 ml of 70 % ethanol, vortex gently, then centrifuge briefly again for 3 minutes at 3500 RPM. Pour off ethanol, air dry briefly by inverting tube in a rack with a paper towel beneath, then add 100 μl TE and incubate at 65°C for 10 minutes.

d. Transfer sample to 1.5 ml microcentrifuge tube.

Cutting the DNA:

1) Label your microcentrifuge tubes that contain the dissolved DNA, either alphabetically or numerically.
2) Mark a .5 ml set of microcentrifuge tubes the same way you labeled those above. Additionally, label the tubes with the word "uncut".
3) Mark another .5 ml set of microcentrifuge tubes the same way you labeled those above. However, label the tubes with the word "cut".
4) To those labeled "uncut" add 7μl distilled H_2O, 2μl blue juice, and 3 μl dissolved DNA, with a micropipetteman. Spin for 5 seconds in a microcentrifuge just to get all of the liquid to the bottom of the tube. Place this set of "uncut" tubes in the refrigerator, until the "cut" tubes are ready.
5) For the "cut" tubes add 3μl dissolved DNA, 1μl 10 x H buffer, .5 units Spermidine, 6 units Eco RI, .1 units RNAse, and 4.9μl H_2O, and 2 μl blue juice, per tube. Spin for 5 seconds in a microcentrifuge just to get all of the liquid to the bottom of the tube.
6) Place this set of "cut" tubes in the incubator at 37°C for 2 hours minimum, or maximum overnight.
7) These are now ready to be loaded on the gel.

NOTE: IT IS UNNECESSARY TO CUT THE DNA TO LOAD IT ON THE GEL. BUT YOU MAY DO SO IF YOU WOULD LIKE TO SEE IF THE RESTRICTION ENZYME, Eco RI, IS ABLE TO CUT YOUR DNA. EVEN IF YOU DO NOT WISH TO CUT YOUR DNA,THE UNCUT DNA MUST STILL BE PREPARED THE WAY DESCRIBED ABOVE.

Making and running a standard agarose gel: Dr. Andrew Paterson's Procedure modified for the classroom

(See Figure 2 and Figure 3)

1) Tape ends of gel mold shut with labeling tape. Run fingernail over tape to be sure of good contact with gel mold. Tape can be used at least twice, so do not hesitate to reuse it.

2) Place well combs in gel mold. Its good to do this now, so you don't forget later.

3) Make 1.0 liters of 1x NEB per gel. This is made from the 10x NEB stock solution, by diluting 100 ml of 10x stock with 900 ml distilled water. 1X NEB CAN BE USED SEVERAL TIMES.

4) Place 275 ml of 1x NEB in a 500 ml flask. Add 2.0 grams of agarose (for 0.8% gel).

5) Heat in microwave for about 3 min. per 275 ml, to boil and melt agarose. Try not to let it boil out of flask. Also, be sure that agarose is completely dissolved -- liquid should be clear, with no remaining agarose.

6) Cool molten agarose to 65°C. (warm to the touch, but you can hold it comfortably without using hot pads.)

7) When molten agarose is 65°C or cooler, pour into gel mold.
NOTE: IF IT GETS BELOW 55° C, IT WILL BEGIN TO SOLIDIFY AND WILL BE DIFFICULT TO POUR. If this happens, reheat in a microwave or boiling water bath.

8) The gel takes 30-40 min. to solidify at room temp. If you need to speed it up, let it cool at rm. temp for 10 min., then put in the 4°C refrigerator for another 10 min.

9) When gel is solidified, remove tape from ends. Save the tape, it can be used again.

10) Set gel in electrophoresis chamber, and immerse with the rest of your 1x NEB. The gel should be just covered by the NEB, too little and the gel will dry out, too much and the electrophoresis time will be much longer. Gently remove the combs.

11) Load samples with a micropipettor. It is unnecessary to change tips if you rinse them with buffer (from the electrophoresis chamber) between samples. Do not overload the wells because it will cause smearing of your gel. The first well in each row is supposed to be loaded with a known amount of uncut Lambda DNA, the second well is supposed to be loaded with half the amount of the Lambda DNA, of Lambda/Hind III.
NOTE: IF YOU HAVE CUT AND UNCUT DNA, IT IS CUSTOMARY TO PLACE THE UNCUT SAMPLE IN THE FIRST WELL, NEXT TO THE LAMBDA Hind III, THEN THE CUT SAMPLE IN THE SECOND WELL, THEN THE NEXT SAMPLE UNCUT IN THE THIRD WELL, AND THE CUT SAMPLE IN THE FOURTH WELL, ETC.

12) Set power supply to 22 volts for about 20 (±2) hour run, or 33 volts for 13 (±2) hour run. Under normal conditions, it is not advisable to go above 33 volts, poor resolution will be the result.
A good compromise of speed and resolution is to let your gel run overnight at 22 volts, and turn it up when you arrive in the morning to accelerate its finish. This assumes a 20 x 25 cm gel, with 7.5 cm between rows of samples. A smaller gel would require much less time to be completed.

13) Make sure there are small bubbles coming from the electrodes, which indicates that power is running through the gel. The DNA runs from negative to positive. Always check about twenty minutes after starting the gel, to make sure that the blue line is moving in the right direction. If it is running in the wrong direction, stop it. Then turn
the gel around and restart the gel.

Appendix A
Preparation of Solutions:

Extraction Buffer: (per 20 L)

0.35M Sorbitol	(1275 g)
0.1M Tris-base	(242 g)
0.005M EDTA	(33.6 g)
PVP-10	(60 g)
DIECA	(20 g)

Adjust pH to 8.25 with HCl
Add Sodium Bisulfite 3.8 g/L just before using.

Nuclei Lysis Buffer: (per 10 L)

200 ml of 1.0M Tris
200 ml of 0.25M EDTA
400 ml of 5.0M NaCl
20 g of CTAB
200 ml of distilled H20

CIA:

Take 160 ml out of a Chloroform bottle and replace with 160 ml of Iso-Amyl Alcohol bottle.
Mix thoroughly.

70% Ethanol:

Take 70 ml ethanol and fill to 100 ml with distilled water and cool in -20°C freezer.

TE:

Tris 1M pH 8	40 ml
EDTA 0.5M pH 8	8 ml
H20	3952 ml aliquot and autoclave

NEB Buffer: Neutral Electrophoresis Buffer 10X (per 20 L)

Tris (base)	(2420 g)
EDTA (Na_2)	(67.2 g)
Sodium Acetate·$3H_2O$	(340.2 g)

pH to 8.1 with concentrated acetic acid (about 275-350 ml)

Blue juice: (to dye DNA)

0.25% Bromophenol blue
0.25% xylene cyanol FF
30% Ficoll(Type 400; Pharmacia; 17-0400-01)
Dissolved in water
Can be stored at room temperature

Ethidium bromide concentration 10 mg/ml

Appendix B
Chemicals Needed:

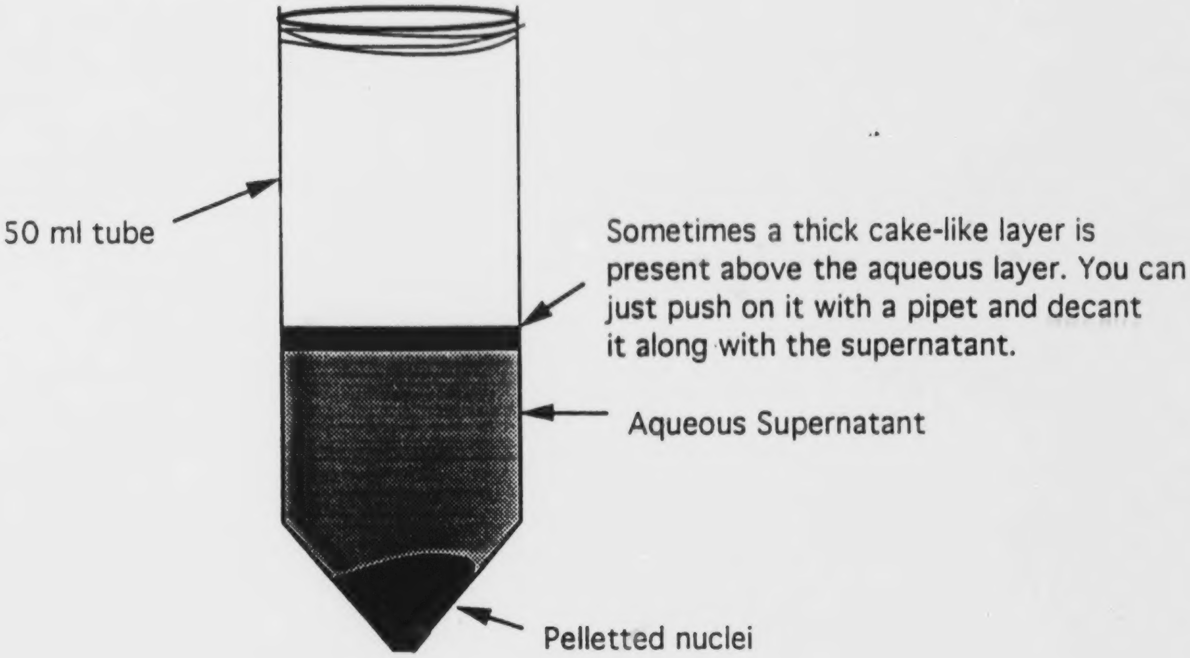
Chemical Name	Company	Catalog Number
Sodium Bisulfite	Sigma	S-9000
Agarose electrophoresis grade	Gibco Brl	5510UB

Chloroform GR F.W. 119.38	EM Science	CX1055-9
Iso-Amyl Alcohol GR F.W. 88.15	EM Science	AX1440-3
Tris (base) F.W. 121.14	Gibco Brl	5504UB
EDTA Disodium Salt: Dihydrate F.W. 372.2	Sigma	ED255
D-Sorbitol	Sigma	S-1876
CTAB Hexadecyltrimethyl-ammonium Bromide	Sigma	H-5882
DIECA - 3 H_2O	Aldrich	22868-0
NaCl AR F.W. 58.44	Sigma	S-9888
Sodium Acetate· $3H_2O$ F.W. 136.1	Sigma	5-9513
PVP-10 average M.W. 10,000	Sigma	PVP-10
Lambda DNA ladder	FMC	50401

RNASE 70units/ng;bovine pancreas	USB	21195
EcoRI & 10XH Buffer 5,000units 8-12units/ l	Fisher/Promega	R6011
Spermidine	Sigma	S2501
Ethidium Bromide F.W. 394.3	Sigma	E-7637
D-Glucose anhydrous F.W. 180.16	Sigma	G-8270
Tris-HCl RG anhydrous F. W. 157.6	Sigma	T-3253
Lambda/Hind III Marker 100 g	Promega	G1711
Labeling tape for gel 3/4" X 60 yd.	CMS	302-406

Company	Phone Number
Sigma	1-800-325-3010
Gibco Brl	1-800-828-6686
EM Science	1-800-222-0342
Aldrich	1-800-558-9160
FMC	1-800-341-1574
USB	1-800-321-9322
Fisher	1-800-766-7000
Promega	1-800-356-9526
CMS	1-800-392-3353

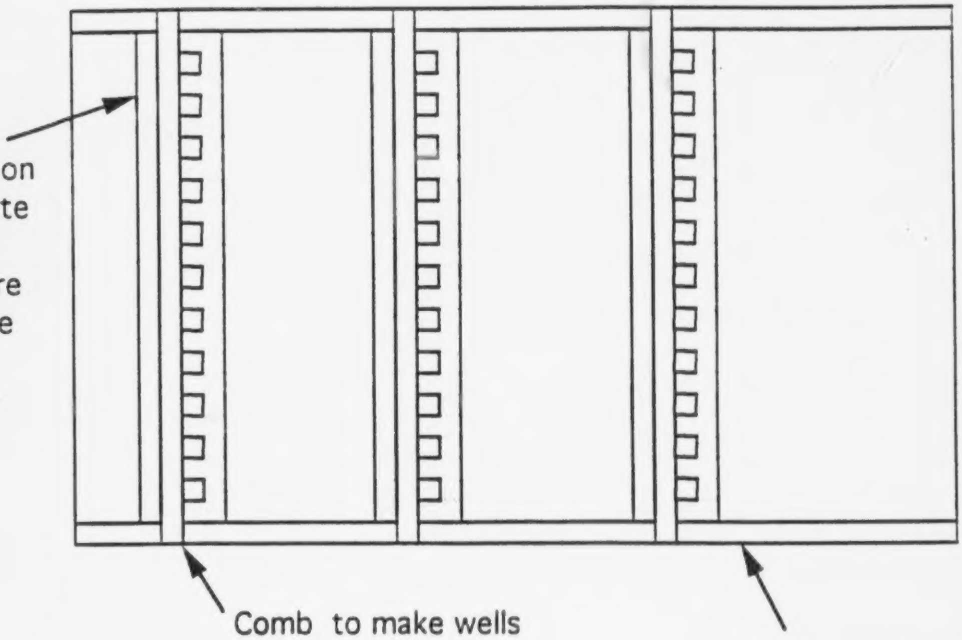
Figure 1:


50 ml tube
Aqueous Supernatant
Pelletted nuclei

Sometimes a thick cake-like layer is present above the aqueous layer. You can just push on it with a pipet and decant it along with the supernatant.

Figure 2:

GEL WITH COMBS



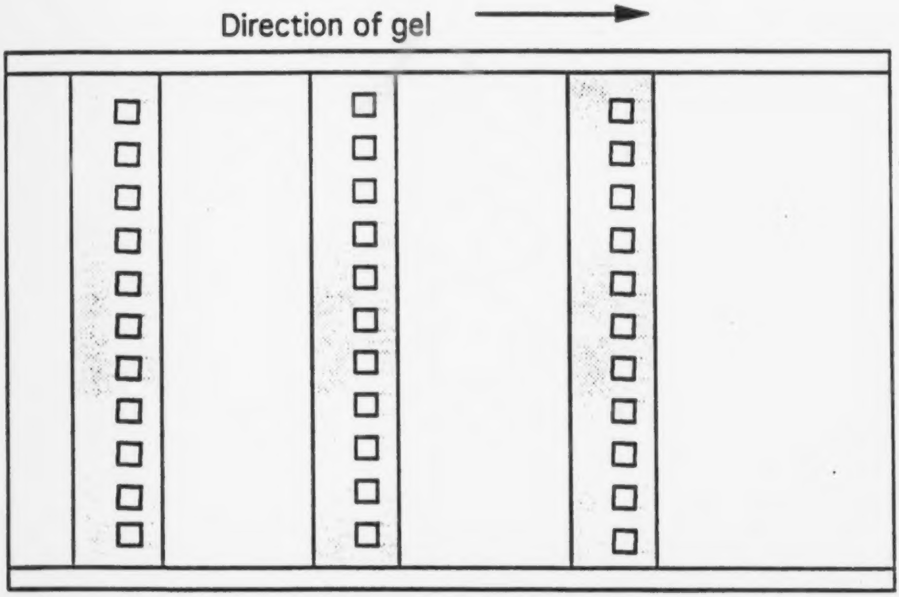
Piece of colored tape on the bottom of the plate where the wells are placed so that they are easier to see when the comb is removed.

Comb to make wells

Wall with grooves that support the combs.

Figure 3:

GEL WITHOUT COMBS



Before removing the combs, be sure that the gel is immersed in NEB buffer in the electrophoresis chamber. This gel will then be ready for samples to be loaded.

To inform students of the various career opportunities available I thought I would include a brief summary of the positions that various people in Dr. Paterson's staff hold.

Dr. Paterson
Title: Assistant Professor in Plant Molecular Genetics in the Department of Soil & Crop Sciences
Bachelor's: Agriculture at the University of Delaware
Master's: Plant Breeding at Cornell University
Ph.D.: Plant Genetics at Cornell University
Duties: Oversee various projects and personnel in the laboratory and conduct cotton, sorghum, maize, sugar cane, and Arabidopsis mapping.

Dr. Jessie Liu
Title: Post-Doctoral Research Associate
Bachelor's: Horticulture in Taiwan
Ph.D.: Plant Breeding at Cornell University
Duties: She is currently working on a project to map the genes responsible for sugar production in sugar cane.

Dr. Stan Kowalski
Title: Post-doctoral Research Associate
Bachelor's: in Biology from University of Pittsburgh
Bachelor's: in Horticulture from Pennsylvania State University
Ph.D.: Plant Breeding at Cornell University
Duties: Managing student worker and maintaining and mapping Arabidopsis crop.

Dr. Mark Burow
Title: Post-Doctoral Research Associate
Bachelor's: in Chemistry/Economics at St. Olaf College, Minnesota
Ph.D.: in Plant Breeding/Biochemistry at University of Wisconsin
Duties: Managing student worker and maintaining and mapping the genes responsible for nematode resistance in peanuts.

Dr. Xingping Zhao
Title: Post-Doctoral Research Associate
Bachelor's: in Agriculture from China
Ph.D. : in Genetics at University of Georgia
Duties: Aiding Dr. Paterson in mapping the Cotton genome.

Jian-Min Dong
Title: Research Assistant
Bachelor's: Agriculture in China

Duties: Extracting cotton DNA. Running gel electrophoresis on extracted DNA. Performing Southern blots. performing hybridization of probes to DNA. developing film to be used for mapping.

Charlene Chang
Title: Research Assistant
Bachelor's: in Horticulture from Taiwan
Master's: in Horticulture from Taiwan
Master's: in Plant Physiology from Pennsylvania State University
Duties: Ordering and maintaining laboratory equipment and supplies. Extracting Sorghum DNA, Running gel electrophoresis on extracted DNA, Performing Southern blots, performing hybridization of probes to DNA, developing film to be used for mapping.

David Lan
Title: Ph.D. student with Dr. Paterson
Bachelor's: in Horticulture from Taiwan
Master's: in Horticulture from Taiwan
Duties: He is currently trying to map the genome of the Brassica Plants.

Cathy Sue Katsar
Title: Ph.D. student with Dr. Paterson
Bachelor's: in International Agriculture from Cornell University
Master's: in Plant Pathology at Texas A&M University
Duties: She is currently working on sorghum.

Yvonne Loin
Title: Master's student with Dr. Paterson
Bachelor's: in Biology at Taiwan
Duties: She is currently attempting to map the sorghum DNA.

Stacy Foster
Title: student worker
She is currently in her third year, studying to obtain her Bachelor's in Genetics/Biochemistry at Texas A&M University.
Duties: Her main duties in the lab are to extract cotton DNA, and to maintain the lab equipment clean and autoclaved.

Joel Hyman
Title: student worker
He is currently in his third year, studying to obtain his Bachelor's in Biomedical Science at Texas A&M University

Duties: Joel works with Dr. Kowalski. His main duties are to help maintain the Arabidopsis plants, and to extract DNA from the Arabidopsis plants.

Frank Amedeo
Title: student worker
He is currently in his third year, studying to obtain his Bachelor's in Chemical Engineering from Texas A&M University.
Duties: His main duties are to extract Sorghum DNA, and determine its concentration.

Acknowledgments:

I would like to thank Dr. Paterson and everyone in Dr. Paterson's laboratory(Especially, Charlene Chang, Stacy Foster, David Lan, and Dr. Jessie Liu) for patiently helping me learn how to extract DNA and load gels. Also I would like to thank Dr. Edward Funkhouser and Mr. Brian Wallenta for the opportunity to participate in this program.

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TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME: Sandra Peterson

INTERNSHIP: Texas A&M University Ocean Drilling Program

SCHOOL: A&M Consolidated High School
College Station, Texas

PRIMARY SUBJECT: Algebra 1

ACTIVITIES:

- Collecting Data
- Writing Data in a Chart
- Relating Data to Functions
- Graphing Data on a Computer

SUMMARY: The purpose of this curriculum projects is to understand what a function is and to define a function using tables and graphs.

RESOURCES:

Biodot International, Inc.
P.O. Box 2246
Indianapolis, Indiana 46206

Ocean Drilling Program
Art Department
Texas A&M University
College Station, Texas 77843

TTIP

Curriculum Implementation Plan
Abstract

NAME: Sandra Peterson

INTERNSHIP: Ocean Drilling Program
Texas A&M University

SCHOOL: A&M Consolidated High School
College Station, Texas

PRIMARY SUBJECT: Algebra 1

ACTIVITIES:
Collecting Data
Writing Data in a Chart
Relating Data to Functions
Graphing Data on a Computer

SUMMARY: The purpose of this curriculum project is to understand what a function is and to define a function using tables and graphs.

RESOURCES: Biodot International, Inc.
P.O. Box 2246
Indianapolis, Indiana 46206

Ocean Drilling Program
Art Department
Texas A&M University

TEACHING PROCEDURE

Day One: Divide the students into groups of four. Each person in the group has a special duty.

One person in the group is responsible for picking up the data sheets, Biodots, and color charts. He/she is to see that everyone in their group receives their materials before first period the next day.

The second person is responsible for making the group's graph on a computer.

The third person is responsible for the class presentation of their groups results.

The fourth person must write a paper explaining what their group discovered from their information.

DAY TWO: Have students wear Biodots to all their classes and record results on their charts.

SUBJECT	COLOR RESULTS

DAY THREE: Have students meet back with their groups and share their results.
Have the student responsible for the computer graph choose a time to come in to put the information on the computer.
Have other students work on their assigned parts.

When the students have completed all of the assignment, the teacher needs to explain that a function is a correspondence between two sets, the domain and the range. A function assigns to each member of the domain exactly one member of the range. Each member of the range must be assigned to at least one member of the domain.

You can represent a function either as a correspondence, as stated in the definition, or as a set of ordered pairs. In our charts the subject is the domain and the color result is the range.

This lesson can be used as an interdisciplinary lesson for freshmen in Algebra 1, biology or physical science, health, English, and social studies.

BIODOT INTERNATIONAL, INC.

P.O. BOX 2246 — INDIANAPOLIS, INDIANA 46206 — (317) 637-5776

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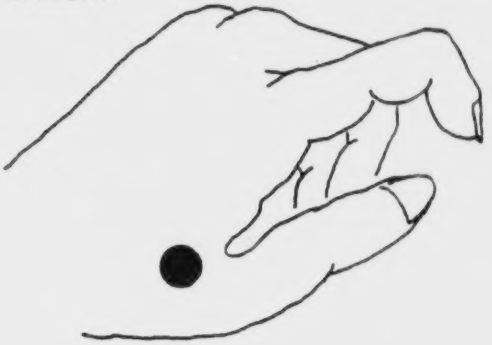

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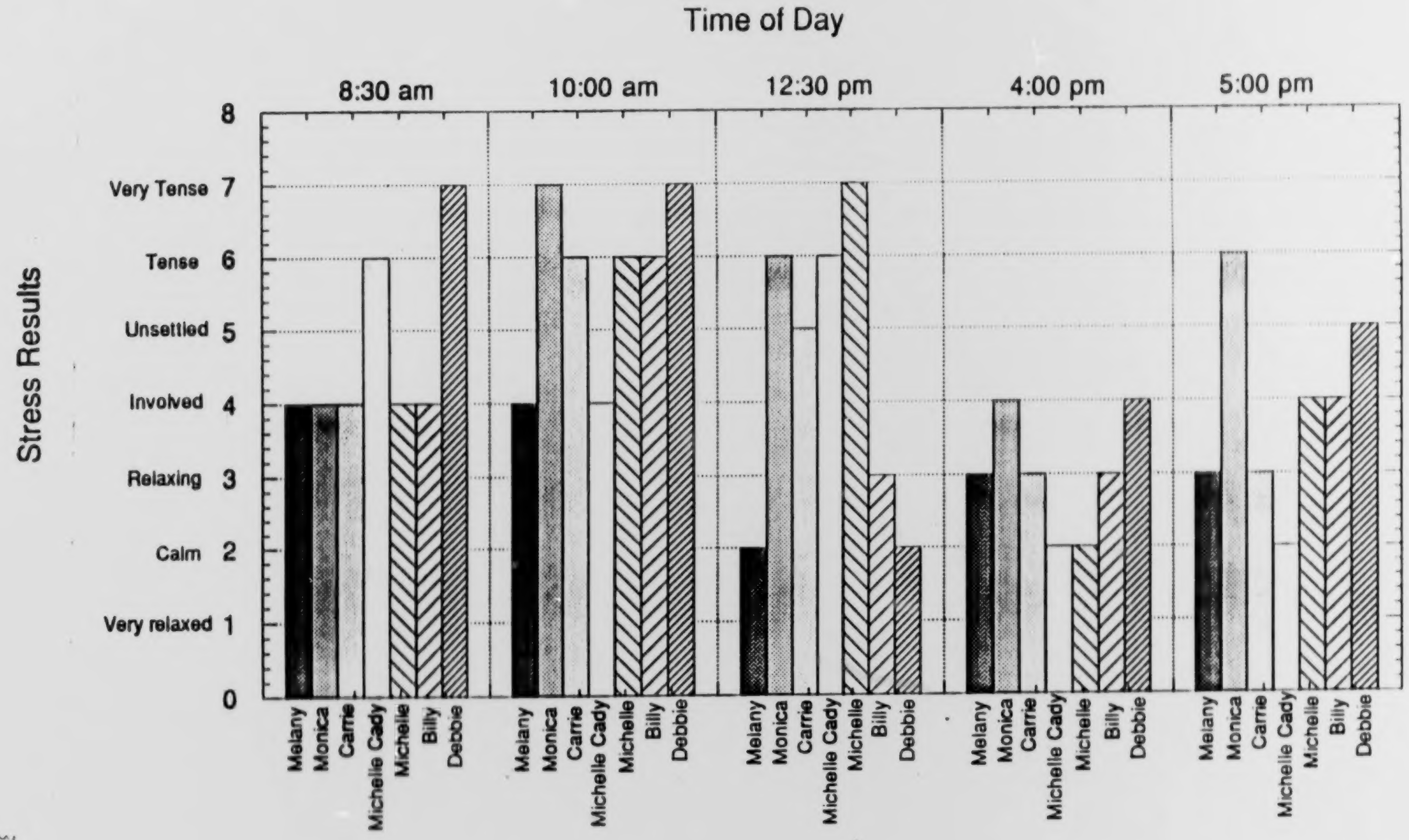
NAME________________________

BIODOT RESULTS

Class	Color results
1.	
2.	
3.	
4.	
5.	
6.	
7.	

Art Room Biodot Results



TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME: Linda Ray

INTERNSHIP: Texas A&M University Ocean Drilling Program
College Station, Texas

SCHOOL: Consolidated High School, College Station

PRIMARY SUBJECT: Business Composite

ACTIVITIES: Integrating Computers with Business & Science

- Use of computers to explain science problems
- Development of professional presentations using software
- Develop communication skills, leadership, and peer cooperation
- Use of computer hardware and software
- Assimilate gathered data, and share results of research with others

SUMMARY: Students need to learn to work in a coorperative atmosphere, these lesson plans will help you pull together students to work in a cooperative manner and will strengthen their communication skills.

RESOURCES:

WEEKLY LESSON PLAN

Teacher LINDA RAY
Course/Level Microcomputer Applications
Unit Integrating Computers with Business & Science

WEEK

Room							
Period	1	2	3	4	5	6	7

Semester [✓ 1] 2 Six Weeks [✓ 1] 2 3 4 5 6

Date	Skill/Concept	Student Behavior (S.W.B.A.T)	Procedures	Assignment	Materials
MON. EE: 75.70D (4)c	Examining issues concerning the use of computer systems	•To use the computer to explain science problems •To use presentation software to develop a professional presentations	Students will use multimedia software to gather data and assimilate data into a computer-driven presentation. Students will prepare the Rain Forest Lesson.		Rain Forest Lesson
TUE	↓	•To develop communication skills•To develop leadership skills •To develop cooperation with peer groups	↓		
WED. EE: 75.70 I.7.A		•To use CD-ROM discs, telecommunications, color scanner and video capture software to gather data			
THUR. EE:		•To assimilate gathered data into a cohesive product •To share results of research with the group and other classes	Groups of students will choose a topic in science and prepare a presentation using the color scanner, CD-ROMs, telecommunications & computer.		CD ROM Discs Laserdiscs Telecommunica National Geogra
FRI. EE:	↓		↓		↓

Getting to Know HyperStudio

In this lesson you will learn how to:

• Start a New Stack •Use the Paint Tools •Add Clip Art
•Add New Cards •Load a Background •Add a Text Item
•Add a Graphic Item •Create a Button to Link Cards Together
• Create a Button to Play a Sound •Create an Animation
•Use the HideShow New Button Action •Save a Stac

Rain Forests of the World

Prepared by Linda Ray
College Station Independent School District

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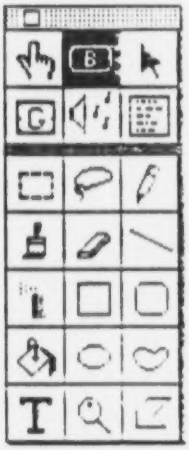
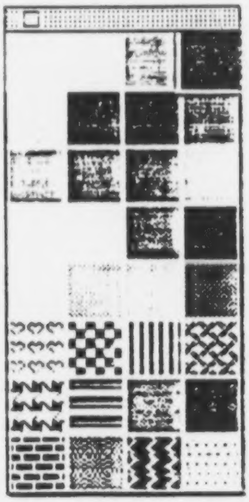
Let's Start a New Stack

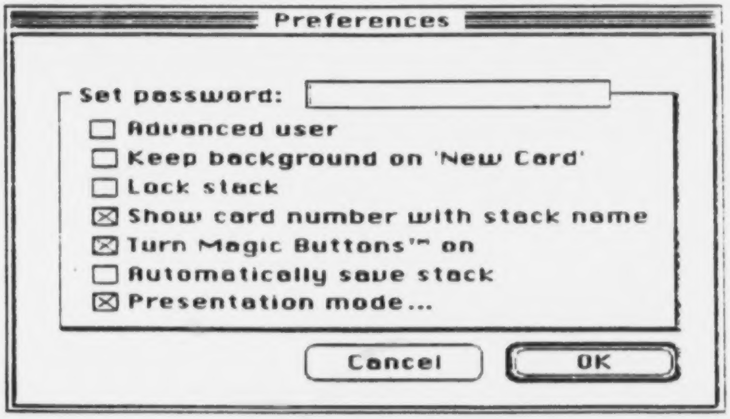
- Choose **File -- New Stack** from the menu bar. Click on **OK** when you see a message appear. Your stack will consist of one card with a white background.

- Tear off the **Tools** palette and the **Colors** palette by dragging down from the menu bar onto the screen as shown below so that you will be able to use them easily during the Hyperstudio session.





- From the **Apple** to the left of File on the menu bar, choose Preferences. Here we will tell HyperStudio to show our card number with the stack name.



Preferences

Set password:
☐ Advanced user
☐ Keep background on 'New Card'
☐ Lock stack
☒ Show card number with stack name
☒ Turn Magic Buttons™ on
☐ Automatically save stack
☒ Presentation mode...

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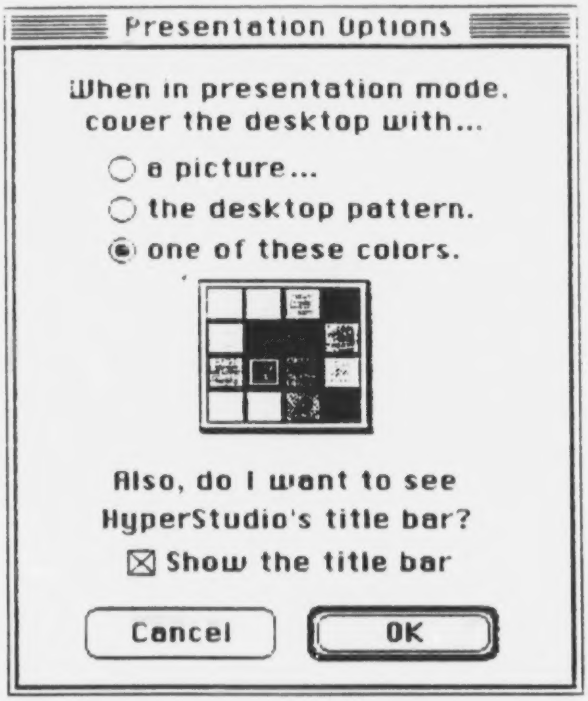
- Click in the box to the left of Presentation mode. A dialog box will open. Here you can choose a background or a color that will cover the outside of each card in HyperStudio. For our lesson on the Rain Forest, choose a light sky blue or a green. Then click **OK**.



Presentation Options

When in presentation mode, cover the desktop with...

○ a picture...

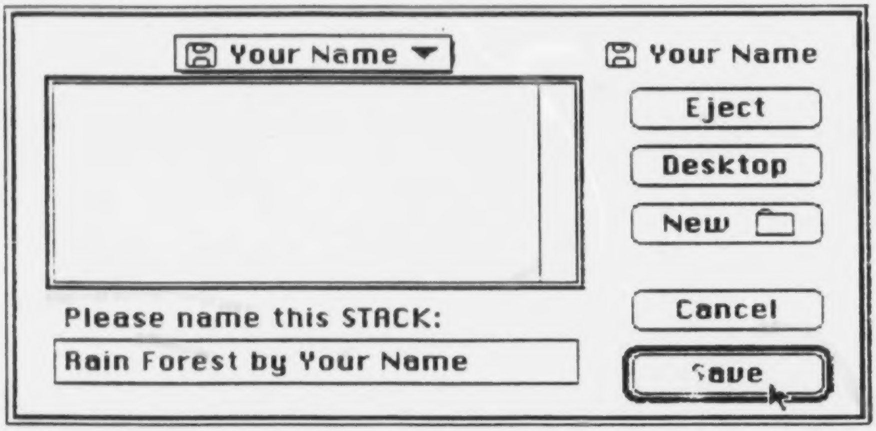
○ the desktop pattern.

● one of these colors.

Also, do I want to see HyperStudio's title bar?

☒ Show the title bar

- Click **OK** again to close the Preferences dialog box.
- Choose File -- Save Stack. Click on the **Desktop** button. Double-click on your disk. Type **Rain Forest by Your Name** as shown below. Click on the **Save** button.



Please name this STACK: Rain Forest by Your Name

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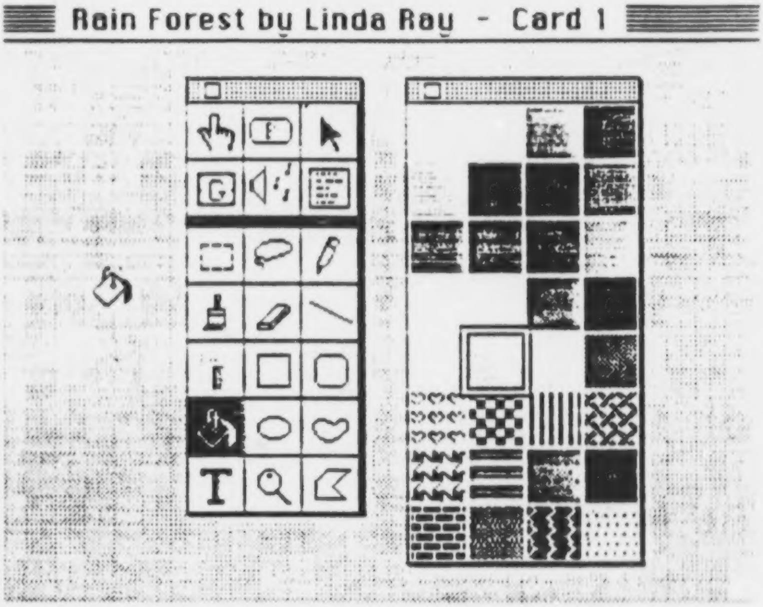
Let's Start an Opening Screen

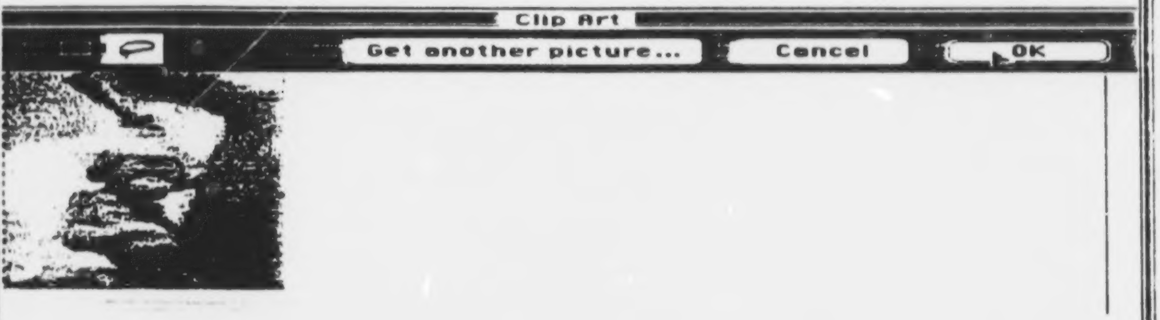
- Choose the **Paint Bucket Tool** from the Tools palette and choose **light blue** from the Colors palette as shown below. Move the cursor to the screen and click one time to cover the screen (or card) with blue paint.



Rain Forest by Linda Ray - Card 1

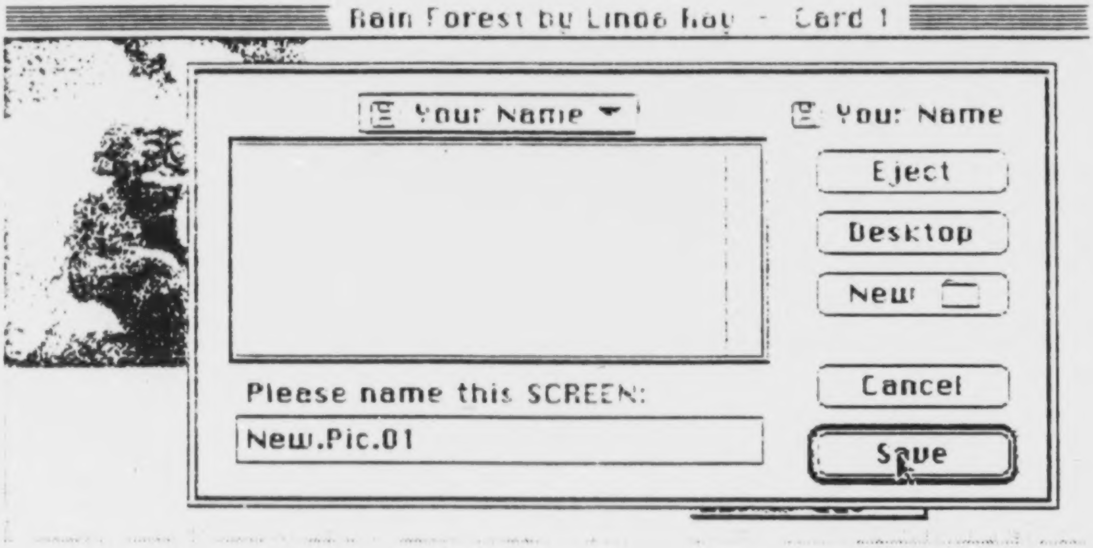
- Choose **File – Add Clip Art.** Click on the **Desktop** button to take you back to the **Macintosh HD.** Double-click on the **Macintosh HD** choice. On the Macintosh HD locate a folder titled "Rain Forest." Double-click on this folder. Inside the folder will be a clip art file titled "Baby Monkey." Double-click on this file.

- Clip art items must be selected by using either the Selection Rectangle or the Lasso tool. Drag a Selection Rectangle around the picture of the **baby monkey** and then click **OK.**



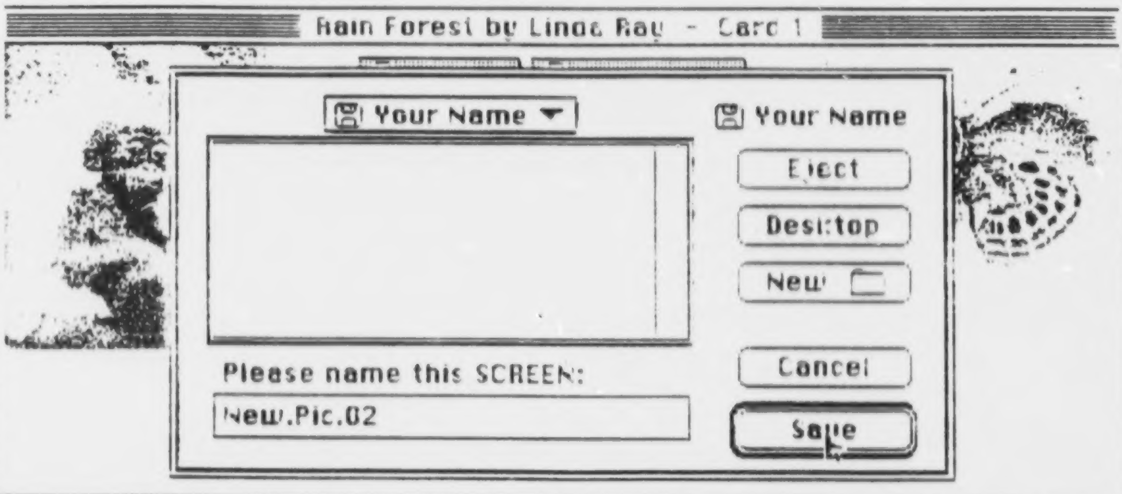
[illegible]

- Choose File -- Save Screen. Click on the Desktop button and then double-click on your disk. Choose the Save button. The screen will be saved as New.Pic.01. The screens that you will be saving will be put together in succeeding steps of this lesson to create an animation that will introduce animals found in the rain forest.


Rain Forest by Linda Ray - Card 1
Your Name
Your Name
Eject
Desktop
New
Cancel
Save

Please name this SCREEN:
New.Pic.01

- Choose File -- Add Clip Art. From the **Rain Forest Folder** on the Macintosh HD, choose **Butterfly**. Draw a selection rectangle around the picture of the butterfly and click **OK**. Drag the picture to the top right-hand corner. Choose **File -- Save Screen**. Click on the Desktop button and go back to your disk. Choose **Save**.


Rain Forest by Linda Ray - Card 1
Your Name
Your Name
Eject
Desktop
New
Cancel
Save

Please name this SCREEN:
New.Pic.02

BEST COPY AVAILABLE

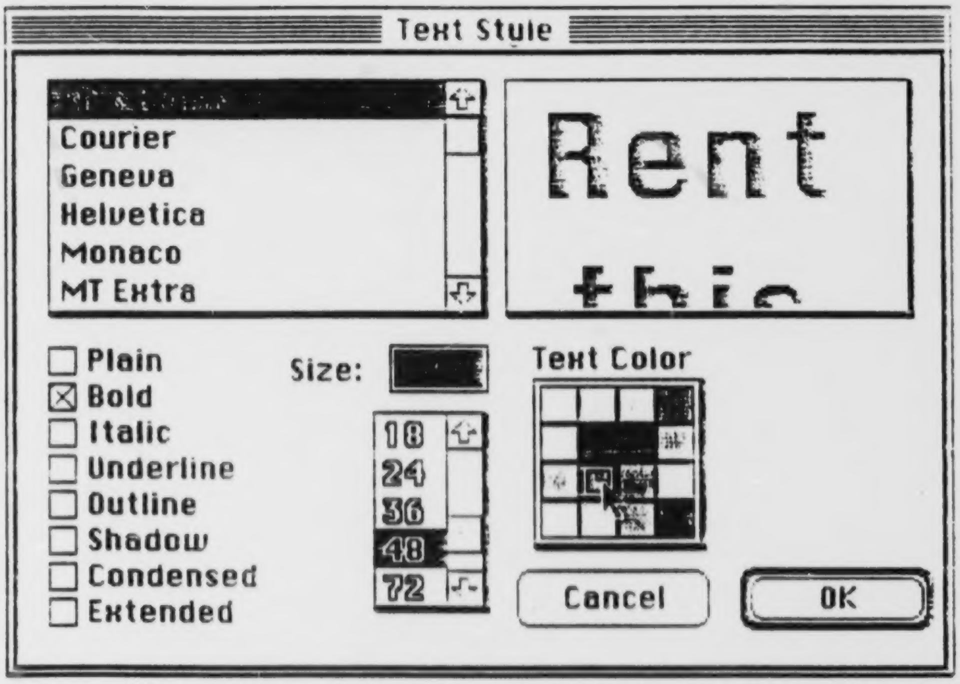
- Choose File -- Add Clip Art. From the Rain Forest Folder on the Macintosh HD, choose the picture of the **Toucan**. Draw a selection rectangle around it and then click **OK**.

- Drag the picture to the bottom left-hand corner. Choose the **Paint Bucket** tool and the light blue color on the **Colors** palette. Pour light blue around the Toucan by clicking in the white space above and below the Toucan.

- Choose **File -- Save Screen.** Choose your disk and save as New.Pic.03.

- Repeat the above steps and add a clip art picture of the "Children of the Rain Forest." This picture will be placed in the bottom right-hand corner of the screen and will be saved as **New.Pic.04.**

- Double-click on the T or Text tool from the tools palette. Choose Chicago, Bold, Size 48 and a color.



☐ Plain
☒ Bold
☐ Italic
☐ Underline
☐ Outline
☐ Shadow
☐ Condensed
☐ Extended

- Type the word **Rain** at the top of the screen between the pictures. Choose **File -- Save Screen** and save on your disk as **New.Pic.05.**

- Type the word **Forests** below the word "Rain" and save the screen as **New.Pic.06** on your disk.

- Type the words **of the** below the word "Forests" and then save the screen as **New.Pic.07.**

- Type the word **World** below the words "of the" and then save the screen as **New.Pic.08.** **Double-click** on the Eraser tool to clear the screen. Save your stack by choose **File -- Save Stack.**.

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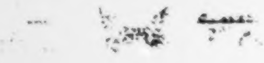


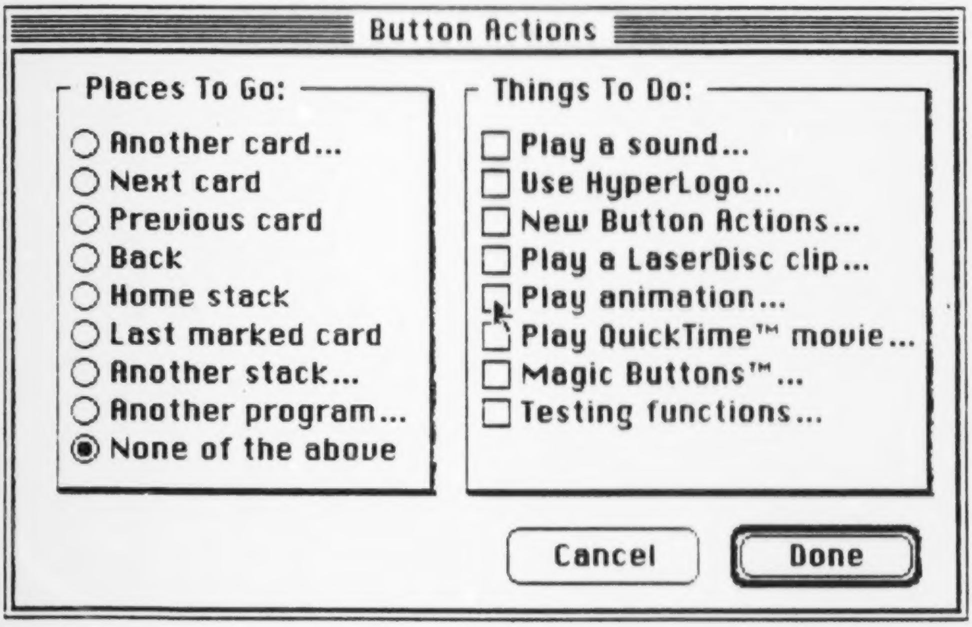
Let's Create an Animation

- Animation in HyperStudio is a process of creating screens and then creating a button that automatically sequences the screens to show the action.

- The screen should now be clear of all the pictures and text that we created and saved as screens. If the screen is not painted a light blue color, choose the Paint Bucket tool and pour paint over it.

- Choose **Objects -- Add a Button.** Under the Type section of the dialog box, choose the **Selection Rectangle** (Third type on the left). The word **invisible** will appear in the middle of the screen. , Click **OK.**

- Click on the screen anywhere outside the Selection Rectangle (Marching Ants). Another dialog box will appear. The **Button Actions** dialog box represents the power of HyperStudio. Please note that from this dialog box actions such as **Places to go** and **Things To Do** are chosen. Only **one** Button Action for Places To Go may be chosen for any one button but many Things To Do may be chosen.



Button Actions

Places To Go:

○ Another card...
○ Next card
○ Previous card
○ Back
○ Home stack
○ Last marked card
○ Another stack...
○ Another program...
● None of the above

Things To Do:

☐ Play a sound...
☐ Use HyperLogo...
☐ New Button Actions...
☐ Play a LaserDisc clip...
☐ Play animation...
☐ Play QuickTime™ movie...
☐ Magic Buttons™...
☐ Testing functions...

- The first choice that we will make is to make this button a **Magic Button**. which is a button that will be activated automatically upon opening of this file. We want the animation to be launched without the user of the stack clicking on a button.

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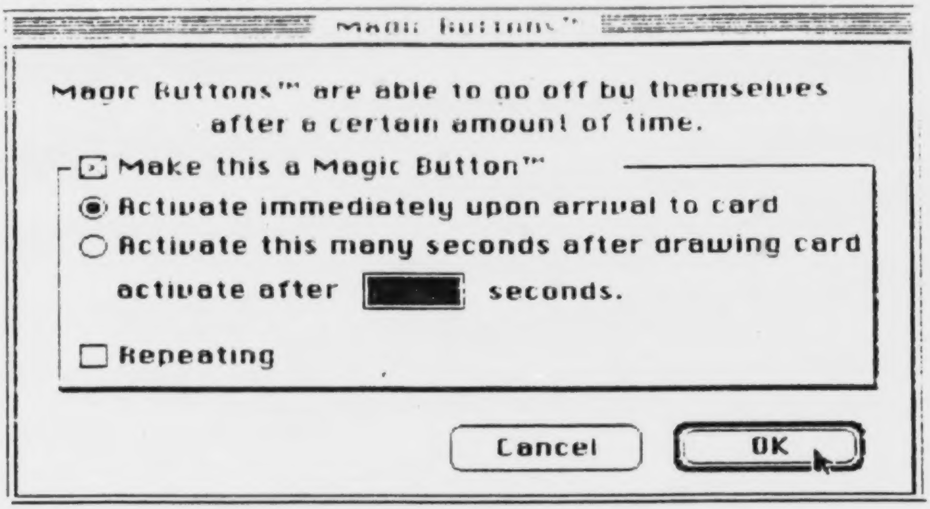
- Click in the box to the left of **Make this a Magic Button** and click in the circle to the left of **Activate immediately upon arrival to card.** Click **OK.**



Magic Buttons™

Magic Buttons™ are able to go off by themselves after a certain amount of time.

☑ Make this a Magic Button™

● Activate immediately upon arrival to card

○ Activate this many seconds after drawing card

activate after ▆ seconds.

☐ Repeating

- Choose **Play Animation** from the Button Actions dialog box. Click on the Desktop button and move to your disk. Select the file **New.Pic.01.**

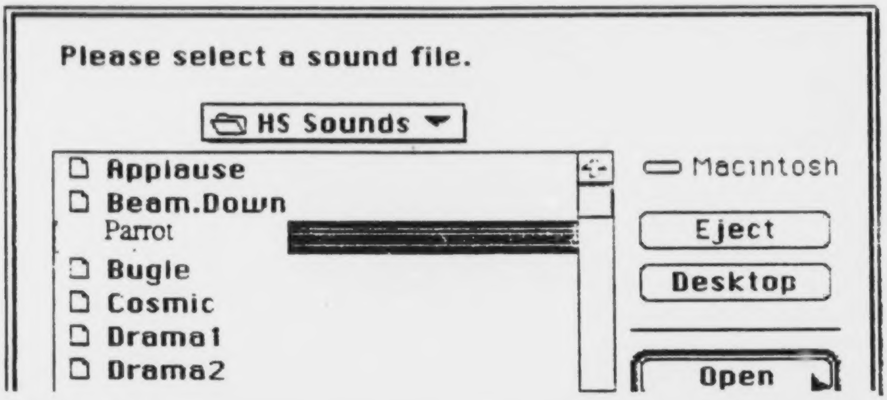
- Draw a selection rectangle around the entire screen of New.Pic.01 and then click Ok. Click outside the selection rectangle (on the title bar next to "Card 1").

- HyperStudio will now begin processing all of the saved screens in the sequence on your disk. When the process is complete, another dialog box will appear on your screen.

- Type **40** in the Play Speed box. You may want to click the **Try It** button although you cannot really tell much about your completed animation. Click **OK.**

- On the Button Actions dialog box, choose **Play a Sound.** A Tape Deck dialog box will appear on your screen. Click on the button to the left of **Disk Library.**

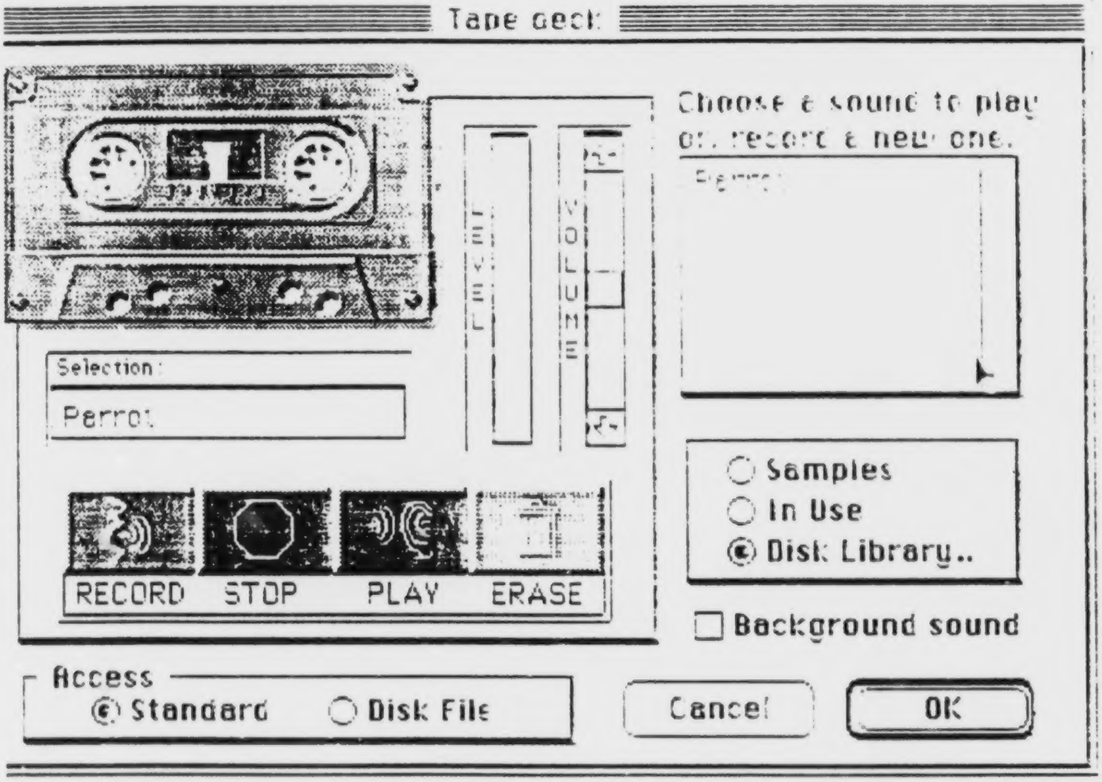
- Move to the Hyperstudio folder on the Macintosh HD. Choose the folder **HS Sounds.** A list of prerecorded sounds will appear on your screen. From this list of sounds, choose **Parrot.**



Please select a sound file.

- [illegible] Parrot. [illegible]

- The selection [illegible] animation button [illegible] Magic Button that [illegible] play the animation [illegible] Parrot.



Choose a sound to play or record a new one.

Selection: Perrot

○ Samples
○ In Use
● Disk Library..

☐ Background sound

Access
● Standard ○ Disk File

- The Tape Deck dialog can also be used to record your voice announcing instructions or directions to the user of the stack. To use it, you would click on the Record button to begin a recording and click on the Stop button when the recording is finished. Be sure to title each recorded message.

- Music may be recorded on a button with or without other audio recordings. Notice the **Background sound** option above. By clicking in this box, background music may be recorded in conjunction with your voice or other sounds.

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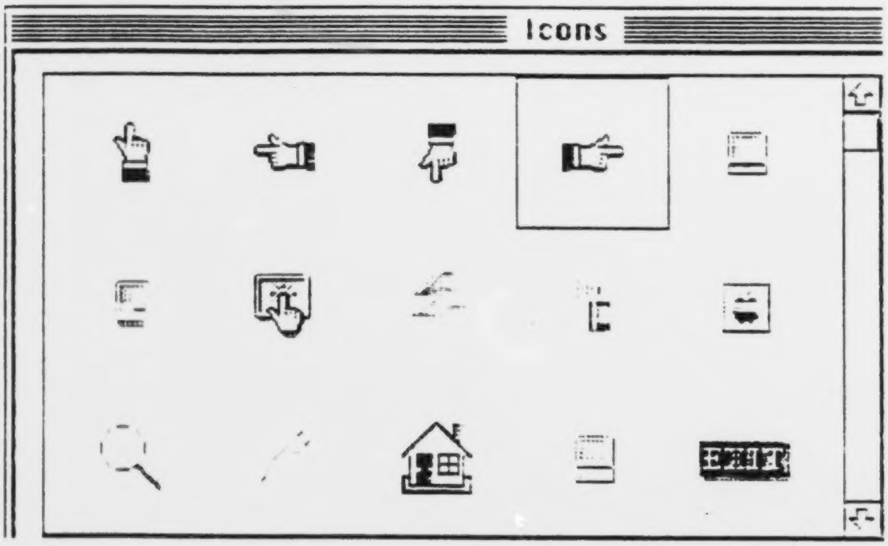
Let's Add a New Card

- Choose **Edit -- New Card.** Card 2 is now part of the stack. Choose **Move -- First Card** to return to the first card.

- Choose **File -- Save Stack** or Command S. It is a good idea to save frequently.

- You will now create a button that will take the user from Card 1 to Card 2. Choose **Objects -- Add a Button.** Choose the selection rectangle so that the button will be invisible. Click on the **Icon** button at the bottom of the dialog box.

- Choose the Hand Pointing to the Right icon and then click the **OK** button.



- Click **OK** to close the **Button Appearance** dialog box. Drag the icon to the bottom right-hand corner of the screen and then click anywhere outside the button.

- Click on the circle to the left of the **Next Card** option. A dialog box will open. Choose any transition of your choice.

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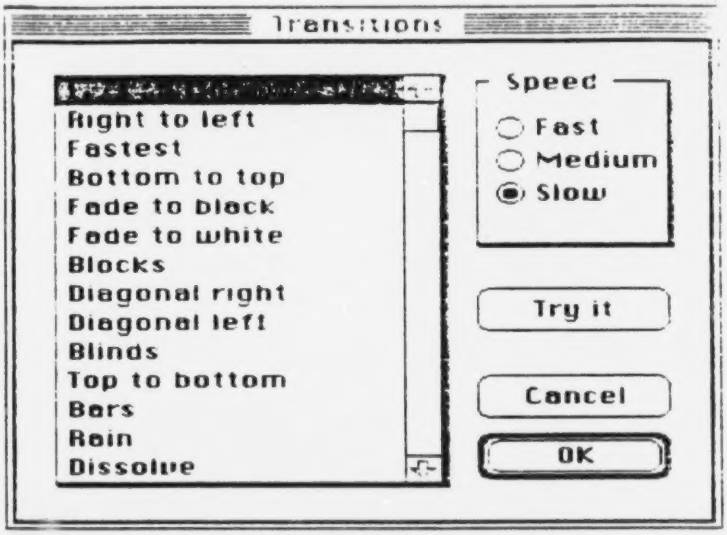
[illegible]

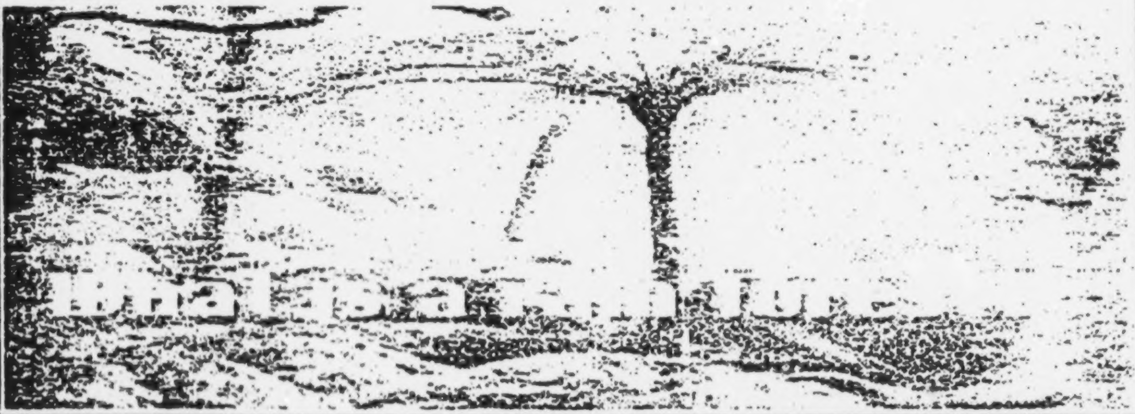

Transitions
Right to left
Fastest
Bottom to top
Fade to black
Fade to white
Blocks
Diagonal right
Diagonal left
Blinds
Top to bottom
Bars
Rain
Dissolve
Speed
○ Fast
○ Medium
● Slow
Try it
Cancel
OK

- If you have not closed the Button Actions dialog box for the Next Card Button, please click on the **Done** button to do so. The animation should appear on the screen. Click on your new button at the bottom of the screen to go to the next card. Don't worry that it cannot be seen easily behind the animation. That is normal.

- Choose **File -- Add Clip Art.** From the Rain Forest Folder on the Macintosh HD, choose the file Ferns. Be sure to place a selection around it before clicking on the **OK** button.

- Drag the picture until it is in the top left corner of the screen. Hold down the **Command** key (next to the space bar) and drag the bottom right corner of the fern picture until it covers the entire card.

- Double-click on the T and choose a bright color, size 24, and bold. Then type **What is a Rain Forest?** on the bottom of the screen. Use the Delete key or Edit -- Undo Painting if you make a mistake.



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Let's Add a Magic Button

- Choose **Edit -- New Card**. Choose **Move -- Previous Card**.

- From Card 2 choose **Objects -- Add a Button**. This will be an invisible button. Click **OK**.

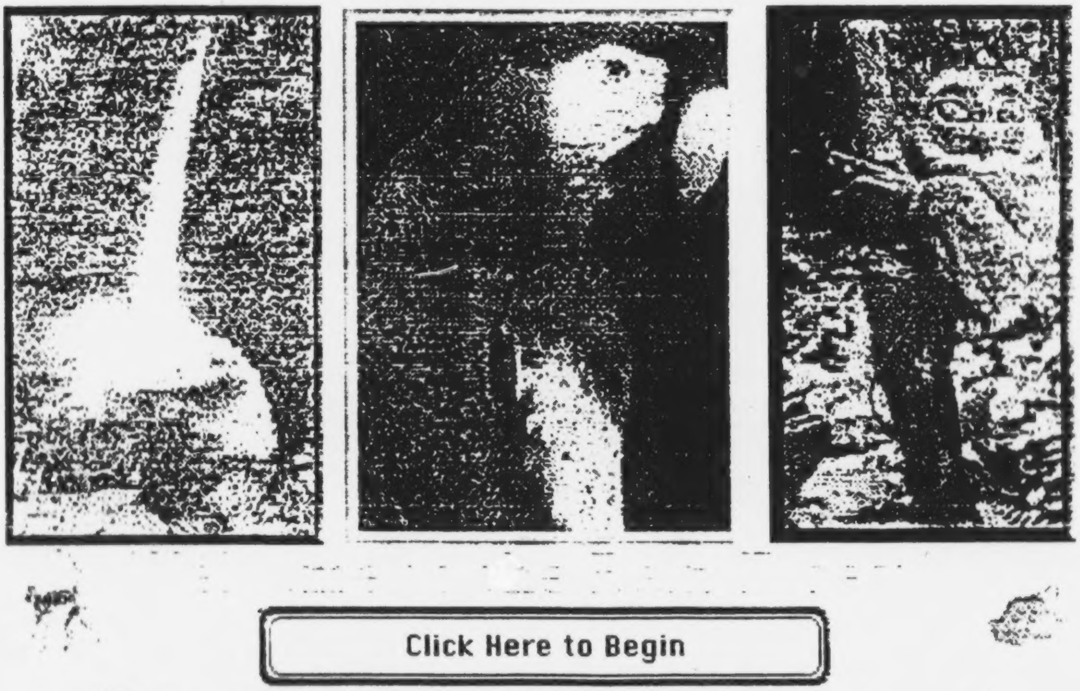
- Click outside the button on the screen and then choose the **Next Card** option. Choose the transition **Dissolve**.

- Choose the option **Magic Button**. Click on the box to the left of **Make this a magic button**. Click on the **OK** button.

- Click on the option **Play a Sound**. Click on the button to the left of the option **Disk Library**. From the **HS Sound** folder open the sound **Brook.Rpt** and then close the Tape Deck dialog box.

- If all of the actions on this button are correct, the button should activate three seconds after the card is opened, the sound **Brook.Rpt** should play and then the next card should be seen on the screen.

- Save your stack. Let's go on to create card 3. An example follows below:



(Click on the Monkey or the Frog to move from card to card.)

Let's Add a Recording

- On Card 3, you will add a Magic Button that will play a recorded welcome.

- Choose **Objects -- Add a Button.** Click on the Selection Rectangle to make the button an **invisible** button. Click **OK.** Click outside the marching ants.

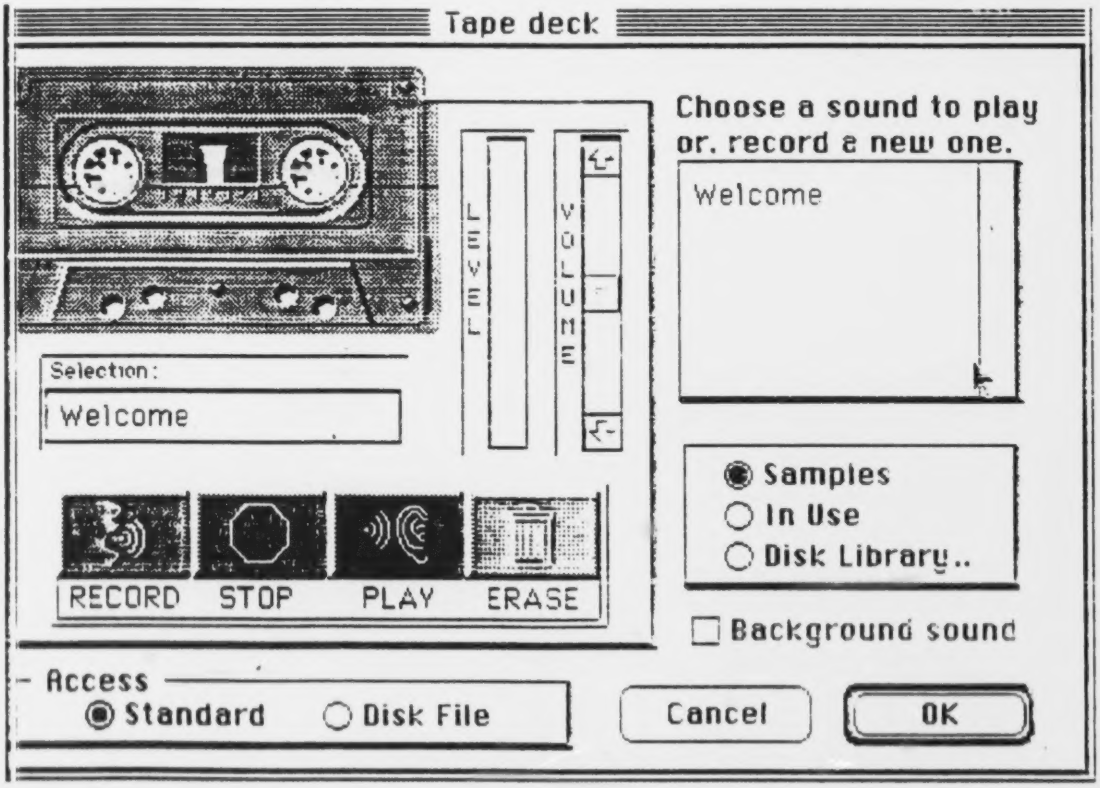
- Choose **Magic Buttons...** Click in the box to the left of **Make this a Magic Button** and choose **Activate immediately upon arrival to card.** Click **OK.**

- Choose **Play a Sound...** Slide the bar to the right of **Volume** to the maximum level. Click on the **Record** button. While using a microphone say **"Welcome to a lesson about the Rain Forest! Click on the button to begin."** Click **Stop.**

- Click on the **Play** button to listen to your recording. You may erase the recording and redo it if desired.

- Highlight the word **Untitled** and replace it with **Welcome** as shown below.

- Click **OK** and then click **Done** to finalize the button.



Tape deck

Choose a sound to play or record a new one.

Welcome

Selection: Welcome

● Samples
○ In Use
○ Disk Library..

☐ Background sound

Access
● Standard ○ Disk File

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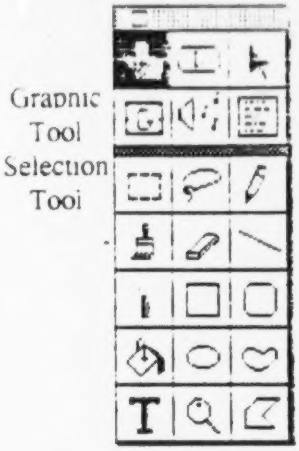
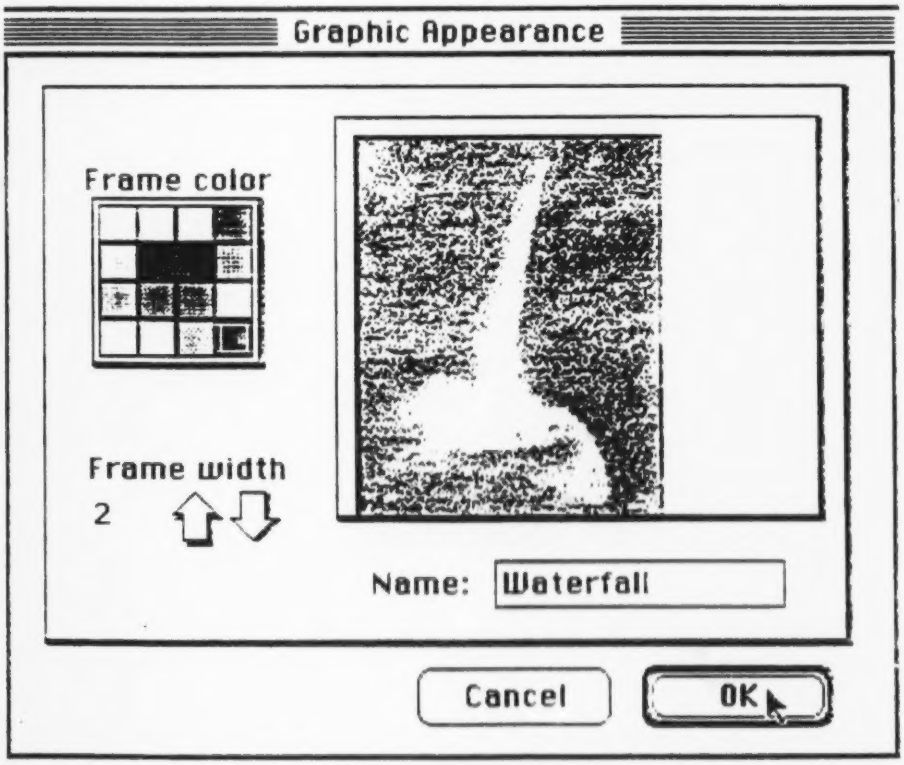
Let's Add a Graphic Item

- Graphic items are similar to clip art items. However, there are a few differences. First, a graphic item cannot be painted over with the text tool. The location or size of a graphic item can be changed by changing to the Graphic Tool and by grabbing the item with the mouse. As you have seen in this lesson, they may have words or titles painted over them with the Text Tool. A graphic item may have a frame of varying widths and colors. HyperStudio gives the user a choice between the two ways of adding pictures to the cards.



- Add thepicture of the Waterfall to Card 3 by choosing **Objects -- Add A Graphic Item.** Select **Waterfall** from the Rain Forest Folder and click **OK.** Drag the picture to the top left of the screen. Click outside the selection rectangle and then choose a frame color. Click **OK.**



Frame width
2

Name: Waterfall

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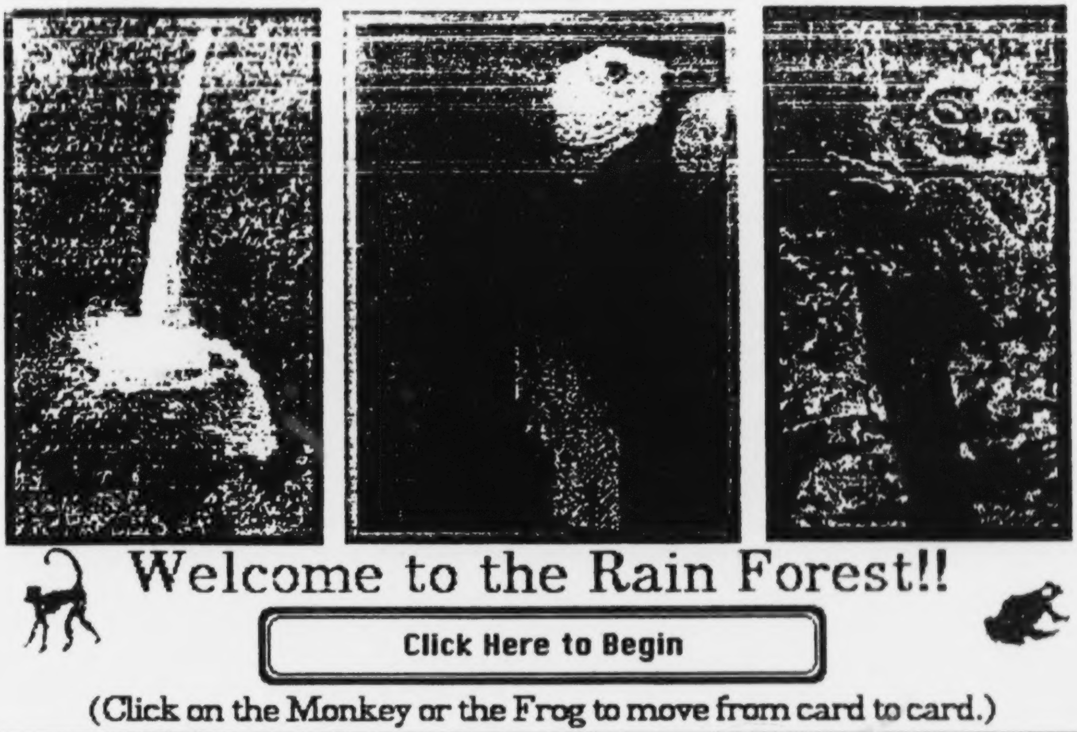
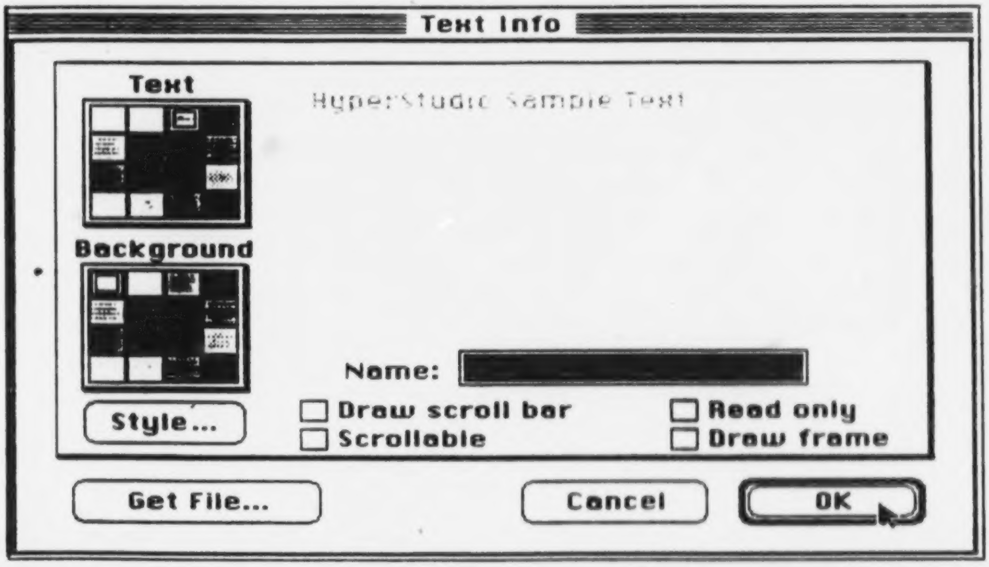

Welcome to the Rain Forest!!
Click Here to Begin
(Click on the Monkey or the Frog to move from card to card.)

- Add the pictures of Toucan II and Tarsier from the Rain Forest Folder to Card 3 by choosing **Objects -- Add A Graphic Item.** Drag the pictures to the top middle and top right of the screen. If the pictures are not the same height, choose the Graphic Tool, click on the picture to select it, and drag the bottom right corner until the picture is the desired height.

- Choose **Objects -- Add a Text Item.** Drag the selection rectangle that appears on the screen and resize it underneath the pictures so that the text "**Welcome to the Rain Forest!**" will fit. Click outside the marching ants. Choose the options as shown above:


Text Info
Text
HyperStudio Sample Text
Background
Name:
Style...
☐ Draw scroll bar
☐ Scrollable
☐ Read only
☐ Draw frame
Get File...
Cancel
OK

BEST COPY AVAILABLE

- Type **Welcome to the Rain Forest!** in the newly created text item. Please note that the Hand Tool or Browse Tool is chosen while you are typing. Text created in a text item may be editted later unlike text created with the T or text tool.

- Highlight the text after you have typed it by dragging from left to right over the text with your mouse. Choose **Options -- Text Style**. Choose **Chicago**, size **24** and **Bold** and then click **OK.**

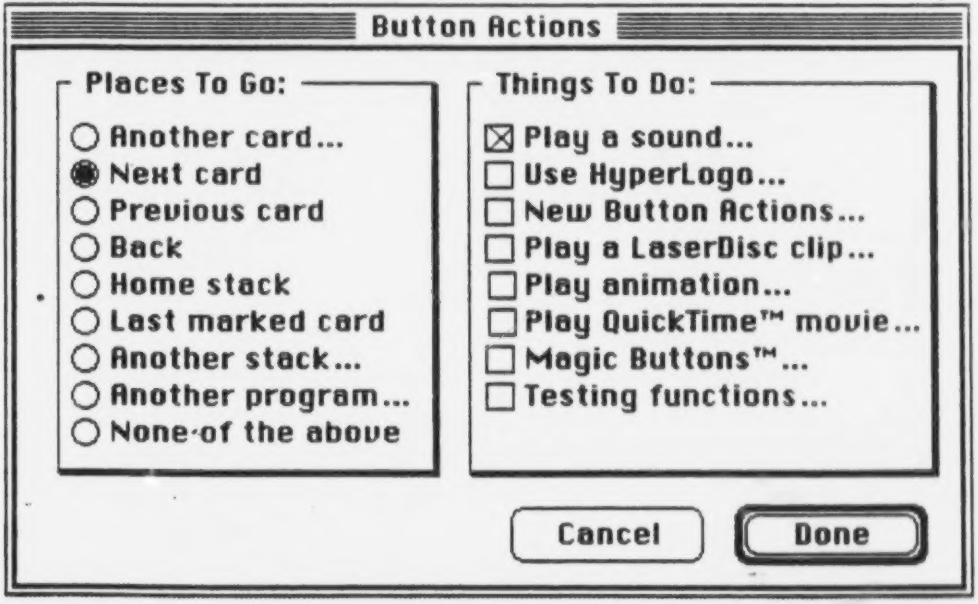
- The next step is to create buttons on the card that will take the user of the stack to the next card or the previous card. We will add two graphic items, the frog and the monkey, to each of the remaining cards in the stack and cover the graphic items with a transparent button that will play a sound and then move to either the previous card or the next card.

- Choose **File -- Add a Clip Art.** From the Rain Forest folder on the Macintosh HD, choose **Trio.** Draw a selection rectangle around the **frog** and click **OK.** Drag the frog to the right of the title **Welcome to the Rain Forest!** Click outside the frog and then click **OK** again.

- Choose **Objects -- Add a Button.** Click on the selection rectangle type to create an invisible button. Click **OK.** Drag the selection rectangle to cover the frog and resize it so that it just covers the frog. Click outside the selection rectangle. Choose **Next card** and then choose the transition **Left to right** at a slow rate. Click **OK.**

- Choose **Play a sound.** Click on the **Disk Library.** Locate the **HS Sound** folder in HyperStudio. Choose **Night Frog.** Click OK. Click **Done.**

- Choose **Edit -- New Card.** Choose **Move -- Previous Card.** Click on your new button to try it out and then choose **Move -- Previous Card** again.



Button Actions

Places To Go:
○ Another card...
● Next card
○ Previous card
○ Back
○ Home stack
○ Last marked card
○ Another stack...
○ Another program...
○ None of the above

Things To Do:
☒ Play a sound...
☐ Use HyperLogo...
☐ New Button Actions...
☐ Play a LaserDisc clip...
☐ Play animation...
☐ Play QuickTime™ movie...
☐ Magic Buttons™...
☐ Testing functions...

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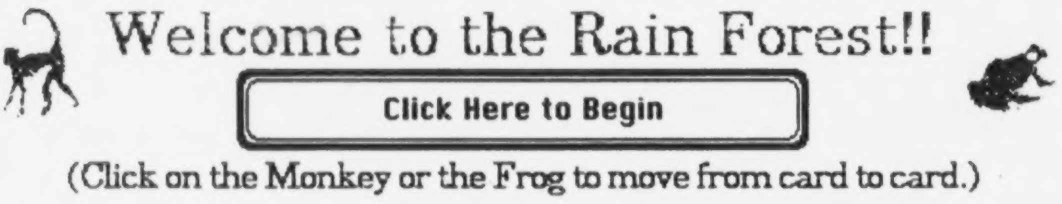
Let's Add a User Name

- Choose **File -- Add a Clip Art.** From the Rain Forest folder on the Macintosh HD, choose **Trio**. Draw a selection rectangle around the **monkey** and click **OK**. Drag the frog to the left of the title **Welcome to the Rain Forest!** Click outside the monkey and then click **OK** again.

- Choose **Objects -- Add a Button.** Click on the selection rectangle type to create an invisible button. Click **OK**. Drag the selection rectangle to cover the monkey and resize it so that it just covers the monkey. Click outside the selection rectangle. Choose **Previous card** and then choose the transition **Right to left at a slow rate.** Click **OK.**

- Choose **Play a sound.** Click on the **Disk Library**. Locate the **HS Sound** folder in HyperStudio. Choose **Monkey**. Click OK. Click **Done.**

- Click on your new button to try it out. Any options on a button can be changed by first clicking on the **B or Button tool** and then double-clicking on the button that is to be changed. The dialog box will have a button **Actions** that will allow you to change anything about a button such as a sound, animation or other action.



Welcome to the Rain Forest!!

Click Here to Begin

(Click on the Monkey or the Frog to move from card to card.)

- To finish Card 3 we will need to create a button that will ask the user of the stack to type in his/her name. This data may be used by a teacher to gain results after a stack is used.

- Choose **Objects -- Add a Button.** Choose a rounded-rectangle button, blue text, and a yellow background. Click in the box to the left of **Show Name. Type Click Here to Begin** as a title for the button. Click **OK.**

- Drag the button so that it is underneath the title "Welcome to the Rain Forest!!" Click outside the button. Choose **Testing Functions...** and then choose **Ask for the User's Name.** Click **OK** and then **Done.**

- Either use the T (or Text tool) or use Objects -- Add a Text Item and type **(Click on the Monkey or the Frog to move from card to card.)** below the Click Here to Begin button.

- Choose the hand or Browse Tool and move to Card 4.

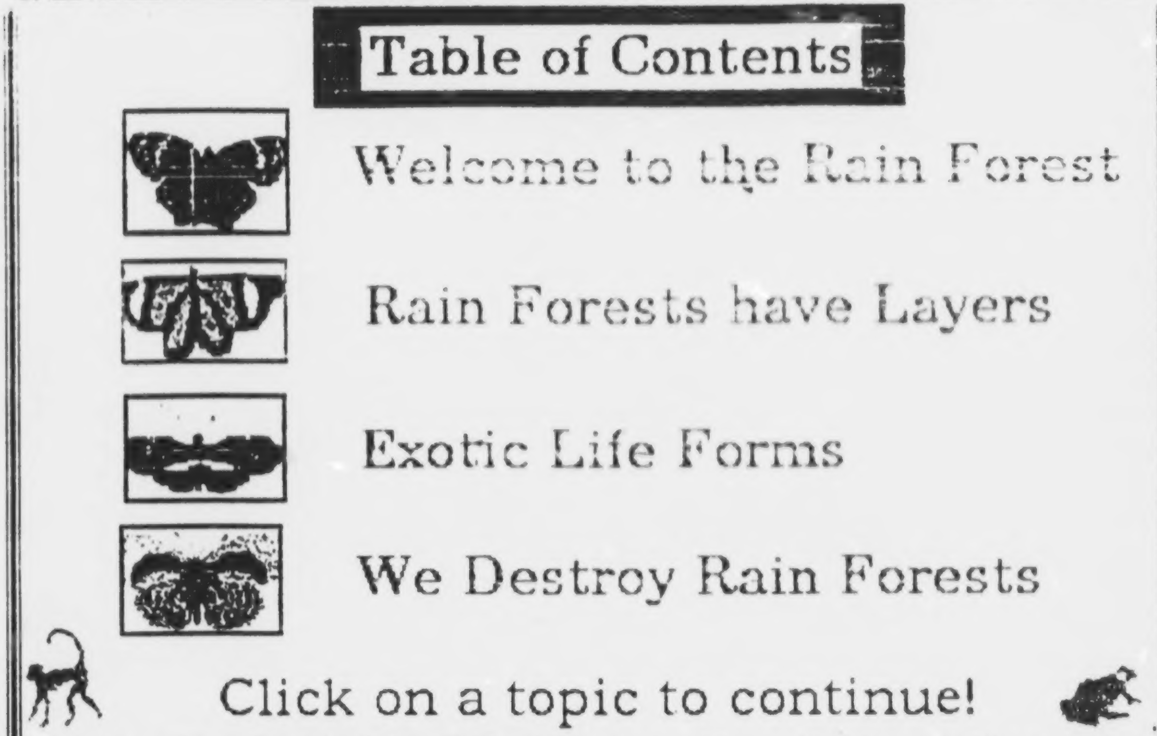


Table of Contents

Welcome to the Rain Forest

Rain Forests have Layers

Exotic Life Forms

We Destroy Rain Forests

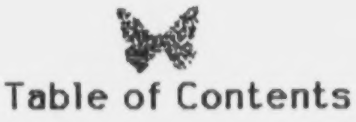
Click on a topic to continue!

- As shown above **Card 4** will be a Table of Contents card from which the user of the stack will branch to other stacks containing information about each topic.

- Under Objects – Add a Graphic Item, add **Butterfly I, II, III, and IV**. Under Objects – Add a Text Item, add text items and type **Table of Contents** and the chapter items as shown above. Remember to highlight the text, use Options – Text Style to choose the size (36, Chicago, Bold) and color desired. Add another text item for the text "Click on a topic to continue!"

- Save your stack. Choose **File -- New Stack.** **Choose File – Save Stack.** Save the new stack as **Welcome to the Rain Forest.** (Be sure to click on the desktop button and save it on your disk.)

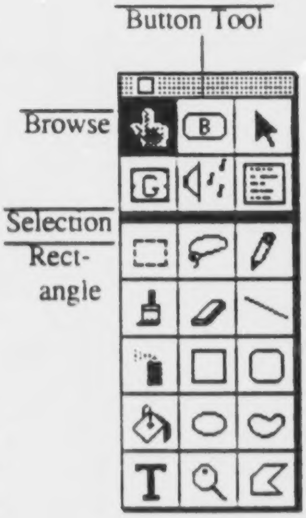
- Choose **File -- Add Clip Art.** From the Rain Forest folder on the Macintosh HD, choose the **Trio** and then place a selection rectangle around the **butterfly**. Add a transparent button that will be named **Table of Contents** over the butterfly. The button will connect to the Rain Forest stack on your disk and may play a sound if you desire. **Save your new stack.**



- Click on the **Table of Contents** button to return to the Rain Forest stack. Choose **Objects -- Add a Button.** Choose invisible and drag and resize the button so that it covers the text **Welcome to the Rain Forest.** Click outside the selection rectangle. Choose **Another Stack.** Choose your newly created stack. You may add a sound and transition before finishing the button.

Click on a topic to continue!

- Move to card 3 of the Rain Forest stack. Choose the Selection Rectangle. Draw a selection rectangle around the picture of the monkey and choose **Edit -- Copy Background.** Choose **Move -- Next Card.** Choose **Edit - Paste Background.** Change to the Hand or Browse Tool. Click on the Table of Contents button. Save your stack as you move to the Welcome to the Rain Forest stack. Choose **Edit - Paste Background.**



- Move to card 3 of the Rain Forest stack. Repeat the above process copying and pasting the frog to card 4 of the Rain Forest stack and to card 1 of the Welcome to the Rain Forest stack. Save your work as you go along in the process.

- Move to card 3 of the Rain Forest stack. Choose the **Button** tool. Click on the next card button that covers the **frog.** Choose **Edit -- Copy Button.** Choose **Move -- Next Card.** Choose **Edit - Paste Button.** Change to the Hand or Browse Tool. Click on the Table of Contents button. Save your stack as you move to the

- Move to card 3 of the Rain Forest stack. Repeat the above process copying and pasting the button covering the frog and the button covering the monkey to card 4 of the Rain Forest stack and to card 1 of the Welcome to the Rain Forest stack. Save your work as you go along in the process.

- Move to card 1 of the Welcome to the Rain Forest stack. The stack should now have three buttons on the card.

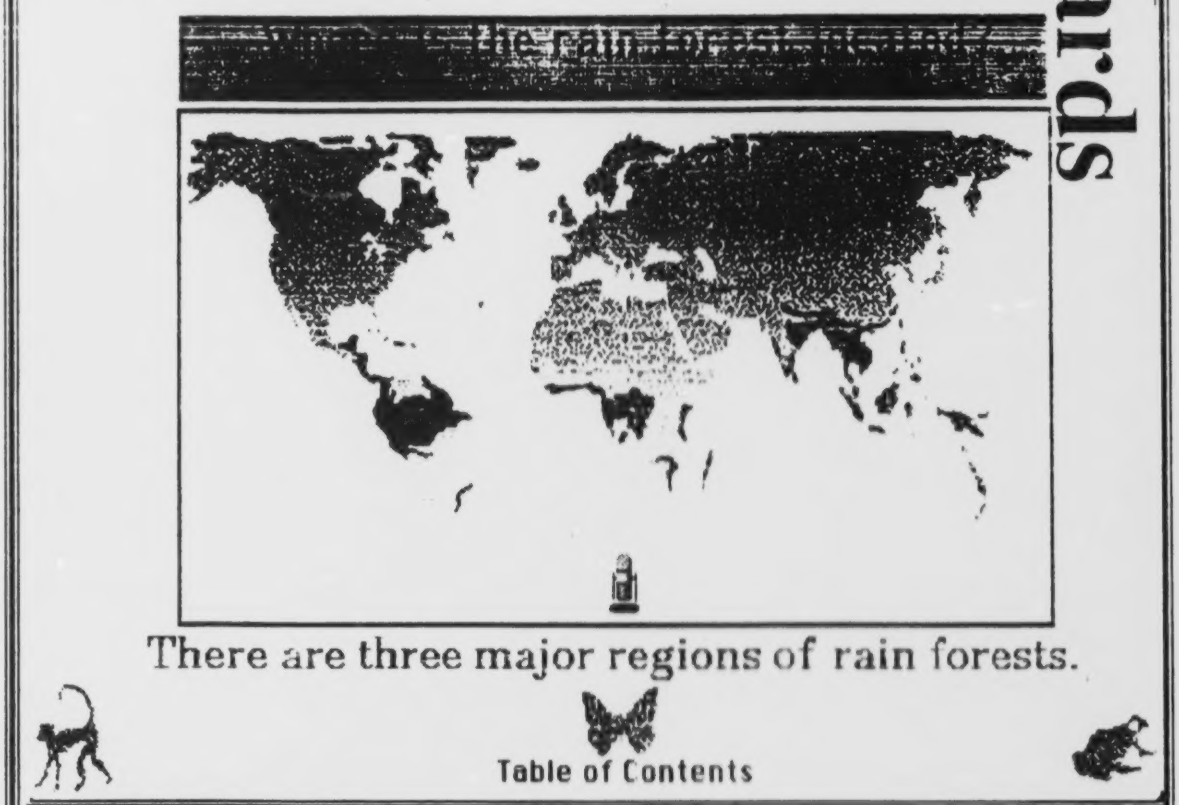
Table of Contents

- Change to the **Paint Bucket** tool. Choose a **light blue** color from the Colors palette. Click on the screen to pour blue over the entire screen. You may need to click near the animal figures at the bottom of the screen to pour blue around them.

- Choose **Edit -- Copy Card.** Choose **Edit -- Paste Card. Repeat Edit -- Paste Card four more times.** You will now have five cards in this stack that will be a prototype from which to quickly produce a stack about the rain forest. The buttons and the basic color will be copied with the card. You may also wish to create a text item on the card before you copy and paste the card to save you development time.

- From Card 1 of the **Welcome to the Rain Forest** stack, choose the **Button tool.** Choose **Edit -- Copy Button. Choose File -- Open Stack** and open the **Rain Forest** stack. On Card 1 of the Rain Forest stack, choose **Edit -- Paste Button.**

Example Cards



Where is the rain forest located?

There are three major regions of rain forests.

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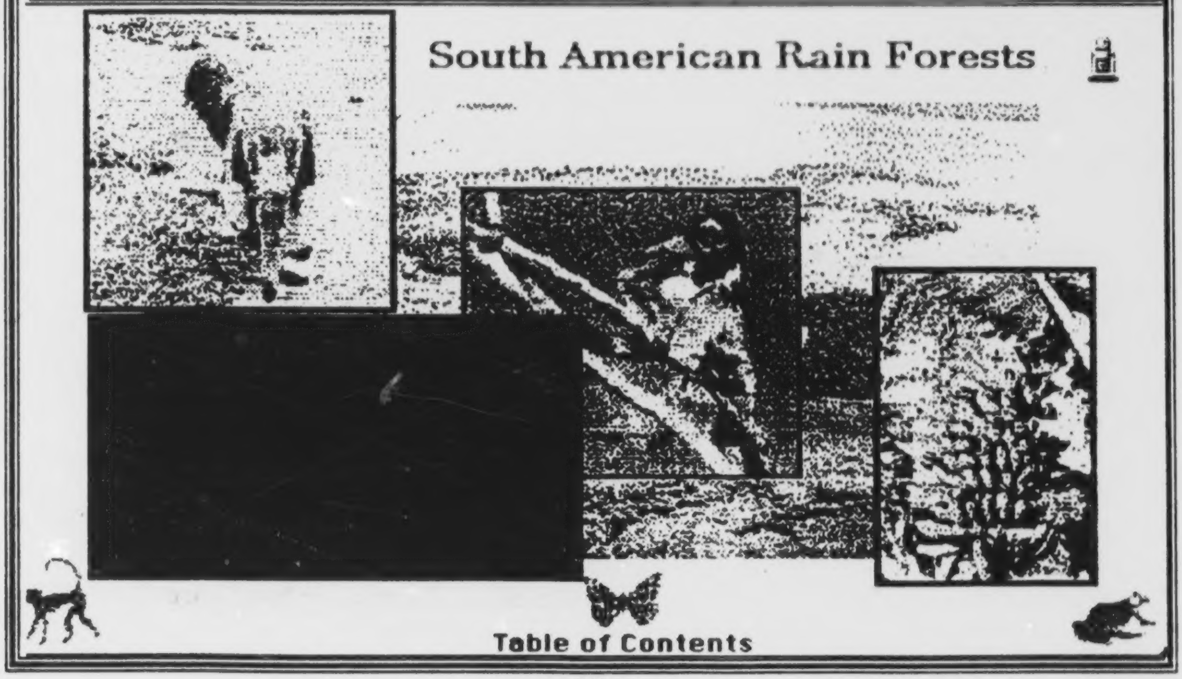

South American Rain Forests

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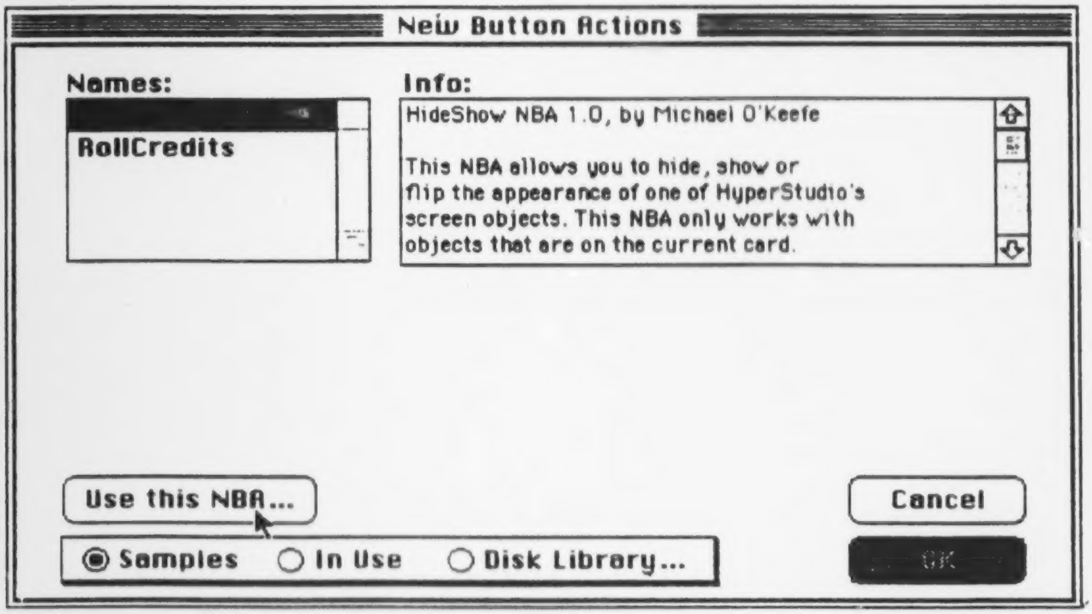
HideShow Buttons

- In the stack **Welcome to the Rain Forest!!** choose **Objects -- Add a Graphic Item.** From the Rain Forest folder, choose **Full Rainforest Pict.**

- **Choose Objects -- Add a Button.** Choose an invisible button and drag the button over the tree frog in the picture. Click outside the button. Choose **New Button Actions** from the dialog box.



New Button Actions

Names: RollCredits

Info: HideShow NBA 1.0, by Michael O'Keefe

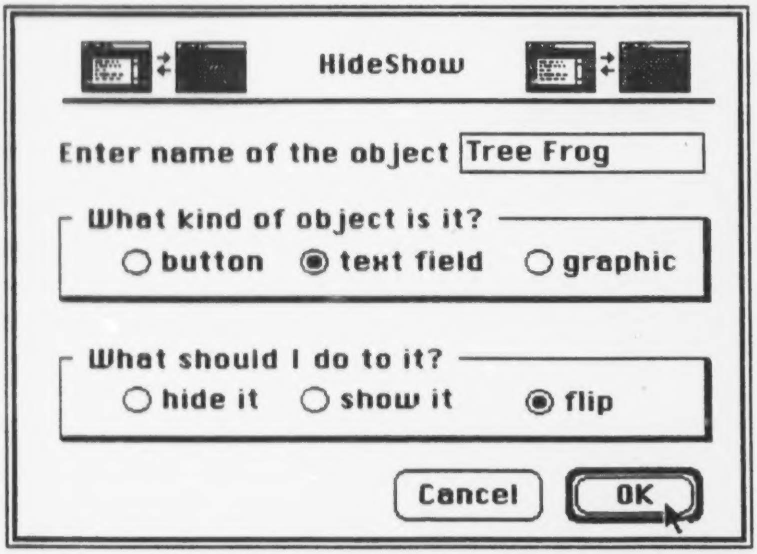
This NBA allows you to hide, show or flip the appearance of one of HyperStudio's screen objects. This NBA only works with objects that are on the current card.

- Choose Use This NBA...

- Make the choices as shown in the dialog box to the right. Click OK.

- Choose Play a Sound. From the Disk Library in the HS Sound folder, choose Night Frog.

- Click OK to complete the button selections.



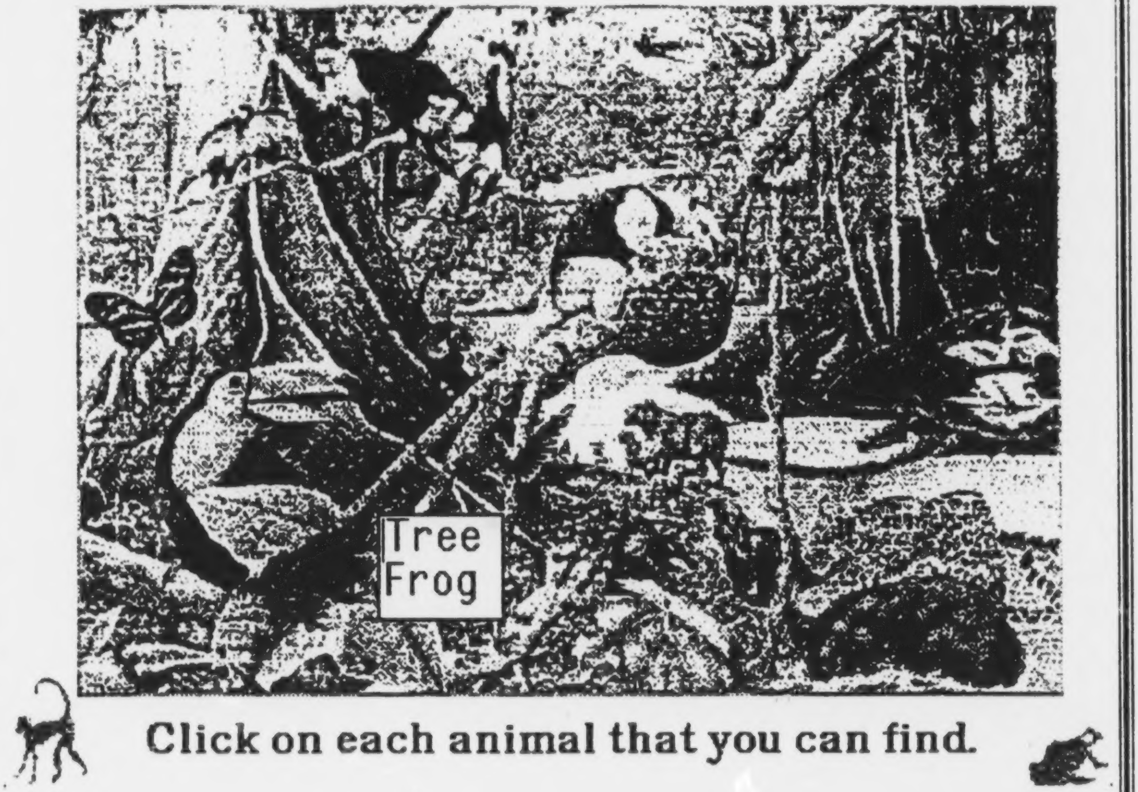
HideShow

Enter name of the object: Tree Frog

What kind of object is it? ○ button ● text field ○ graphic

What should I do to it? ○ hide it ○ show it ● flip

- **Choose Objects -- Add a Text Item.** Position the text box to the right of the picture of the tree frog. Resize the text box so that it is a small text item as shown below. Click outside the selection rectangle. Name the text item **Tree Frog.** Take the X out of the box to the left of Draw Scroll Bar. Click **OK.** Type **Tree Frog** in the text item.



Click on each animal that you can find.

- Continue to create an invisible button over each animal in the picture. Add the New Button Action that will hide/show the text item identifying the animal and add a sound where possible. Remember that each text item must be named exactly the same as the name entered in the HideShow dialog box.

- With the hand or Browse tool, click on each button until no text items are showing. Use File -- Save Stack. This will ensure that all text items are hidden when the stack is opened the next time.

- On the next page are two cards that show ways that HyperStudio can be used to make the stack interactive. With the Testing Functions option in HyperStudio, teachers can open the test results in a word processor and determine whether students are gaining correct information by using the stack.

- **Challenge: Create these two cards in your stack with text items that open with the correct answer and a sound that lets the user know that he/she has chosen the wrong answer.**

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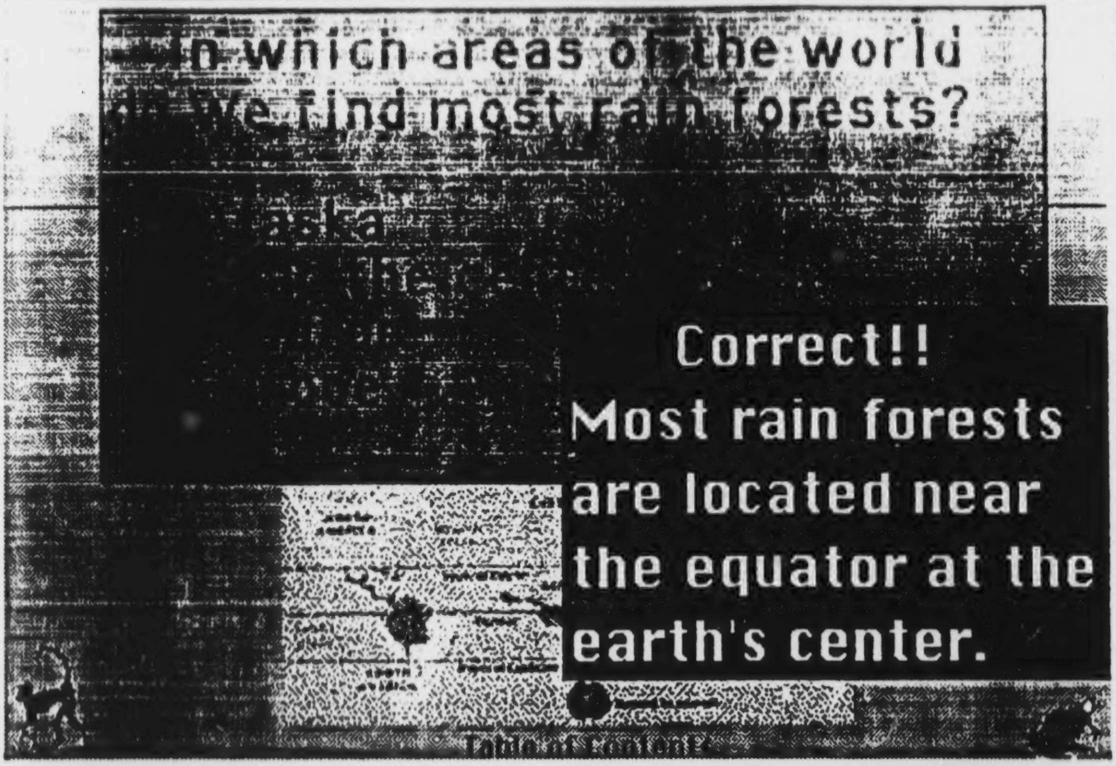

In which areas of the world do we find most rain forests?

Alaska

Correct!!
Most rain forests are located near the equator at the earth's center.

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TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME: Jim Telese

INTERNSHIP: Texas A&M University Ocean Drilling Program
College Station, Texas

SCHOOL: Texas A&M University - College of Education - EDCI

PRIMARY SUBJECT: Science, Mathematics

ACTIVITIES:

SUMMARY:

RESOURCES:

TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME: Albert L. Barr

INTERNSHIP: Texas Parks & Wildlife, Star Enterprise, HL&P
Spring, Texas

SCHOOL: Spring High School
Spring, Texas

PRIMARY SUBJECT: Biology, Environmental Science

ACTIVITIES:

- Water Analysis Using Digital Titrator
- Photosynthesis & Cellular Respiration

SUMMARY: Directions for use of Hach, Ecology Combinstion Test Kit for testing acidity, alkalinity, carbon dioxide, dissolved oxygen, hardness, and pH of water samples. Aslo to utilize all of the water analysis for environmental science classes and honor biology classes.

RESOURCES: Ecology Combination Test Kit
Hach Company
P.O. Box 389
Loveland, Colorado 80539

TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME: Albert L. Barr

INTERNSHIP: Texas Parks and Wildlife

SCHOOL: Spring High School

PRIMARY SUBJECT: Biology, Environmental Science

ACTIVITIES: Water Analysis using digital titrator
Photosynthesis & Cellular Respiration

SUMMARY: Included in this CIP are the directions for using a Hach, Ecology Combination Test Kit for testing the acidity, alkalinity, carbon dioxide, dissolved oxygen, hardness, and pH of water samples. In my current teaching assignment, I will utilize all of the water analysis tests in my environmental science classes and will utilize the photosynthesis and cellular respiration lab in my honors biology classes.

RESOURCES: Ecology Combination Test Kit, Hach Company, P.O. Box 389, Loveland, Colorado 80539

SUMMARY OF INTERNSHIP:

This internship was unique in several ways. First, my mentor was Texas Parks and Wildlife but rather than work at a Texas Parks and Wildlife facility, I was able to work at my school site on a project and Texas Parks and Wildlife came to me. Second, funding for my internship was from three sources, Texas Parks and Wildlife, Star Enterprise, and Houston Lighting and Power. My funding was for four weeks rather than the eight weeks like most internships.

My project was to initiate development of an outdoor study area on a naturally occurring 1.8 acre wetland located on school district property immediately behind Spring High School. The goal of this project is to complete nature trails around the wetland, as well as, a boardwalk across it and an observation platform at one end of it. Eventually an outdoor classroom will be constructed on the site so that students can attend classes there. Money for the construction materials was donated and volunteer labor is being used to put them in. In addition, native species of herbs, shrubs, and trees will be planted in and around the wetland to enhance its value for wildlife. Bird nesting boxes and bat houses will be constructed and located around the wetland. Currently the wetland and its perimeter has over 150 species of plants. Specimens of these will be collected and placed in a herbarium for a reference collection. The site will ultimately be used by students of most curricula in the high school.

Texas Parks and Wildlife gave advice on trail location and construction. They also were able to help on vegetation analysis techniques in the wetland. I see this many uses for advice and help from Texas Parks and Wildlife in the future.

INTRODUCTION TO WATER ANALYSIS TESTS:

This experiment is designed so that students can take water samples or bring in water samples and do several important water tests on them. The tests that can be done with this particular water analysis kit are as follows: acidity, alkalinity, carbon dioxide, dissolved oxygen, hardness, and pH. The water analysis kit is a Hach model AL -36DT, Cat. No. 20638. I choose a Hach water analysis kit because most of their chemicals are premeasured for each test and are contained either in foil packets or powder pillows. With proper safety precautions, there is almost no chance that a student is going to come into contact with a hazardous chemical.

This kit also contains a digital titrator. This apparatus allows students to titrate in a very safe manner and gives a digital readout. It is not electronic but is operated manually. The digital titrator uses premixed cartridges that look something like large hypodermic syringes. They are attached to the titrator along with a delivery tube that will place the chemical directly into the water sample that they are working with. With a titration, you are usually looking for a color change. When the color changes, they can read the value on the digital titrator. This value is either the reading for that test in parts per million (PPM) or mg/L, or it can be easily converted mathematically.

This kit is totally portable and can be taken into the field with you. I purchased six of these so that I can take a class of students into the field and keep all of them busy doing water tests during the class period. It is a very good hands on activity for the students and can be used in middle schools and above.

My test site is located behind the high school and is a naturally occurring wetland 1.8 acres in size. However, the water natural water supply has been cut off and periodically chlorinated water from the local water supply must be used to add water to it. We have installed a 20 gallon container to collect rain water at the wetland site. In the wetland, there is a mixture of rainwater and local water supply that varies depending on rainfall amounts. My students take water samples from the rainwater source, at several places in the wetland, and from the pipe containing the local water supply. In this way, they can obtain a comparison of water from the various sources and may be able to draw conclusions about any changes that they can see in the flora or fauna of the wetland. We also take the air temperature, water temperature, wind speed and direction, and relative humidity on each test day to see if these factors make a difference in any of the water tests.

The following is the procedure for doing each of the water tests. Notes of explanation, reference indicators, and interferences that are given in the procedures have been left out of the following procedures. Although these procedures will only work with the Hach kit, one can see how simple that they are for students to follow. This information is taken form instructions for using the Ecology Combination Test Kit

ACIDITY TEST

1. Attach a clean 180° delivery tube to a 1.600N Sodium Hydroxide Titration Cartridge. Twist cartridge onto titrator body.
2. Flush out the delivery tube by turning the knob until a few drops of titrant are effected from the tube. Wipe tip and reset counter to zero.
3. Take a water sample by filling a clean 100 mL graduated cylinder to the 100 mL mark. Pour the sample into a clean 125 mL Erlenmeyer flask.
4. Add the contents of one Bromphenol Blue Indicator Powder Pillow and swirl to mix.
5. Turn the fine delivery knob to titrate the sample with sodium hydroxide standard solution while swirling the flask until the color changes from yellow to pure green.
6. Read and record the concentration of methyl orange acidity (as $CaCO_3$). Reset the counter to zero.
7. Take another portion of the water sample by filling the 100 mL graduated cylinder to the 100 mL mark. Pour sample into a clean, 125 mL Erlenmeyer flask.
8. Add the contents of one Phenolphthalein Indicator Powder Pillow and swirl to mix.
9. Titrate with sodium hydroxide standard solution until a light pink color forms and persists for 30 seconds.
10. Read the concentration of total acidity (as mg/L $CaCO_3$) from the digital counter window.

ALKALINITY TEST

1. Attach a clean 180° delivery tube to a 1.600N Sulfuric Acid Titration Cartridge. Twist the cartridge onto the titrator body.
2. Flush out the delivery tube by turning the knob until a few drops of titrant are ejected from the tube. Wipe tip and reset counter to zero.

3. Take a water sample by filling a clean 100 mL graduated cylinder to the 100 mL mark. Pour the sample into a clean 250 mL Erlenmeyer flask.
4. Add the contents of one Phenolphthalein Indicator Powder Pillow and swirl to mix.
5. If the color turns pink, titrate with the sulfuric acid standard solution to a colorless end point. If the pink color does not develop, proceed with Step 7.
6. Read and record the concentration of phenolphthalein alkalinity (as mg/L $CaCO_3$).
7. Add the contents of one Bromcresol Green-Methyl Red Indicator Powder Pillow to the same sample and swirl to mix.
8. Continue to titrate with the sulfuric acid standard solution to a light greenish blue-gray (pH 5.1), a light bluish pink-gray (pH 4.8) or a light pink (pH 4.5) color.
9. Read and record the concentration of total alkalinity (as mg/L $CaCO_3$).

CARBON DIOXIDE TEST

1. Attach a clean 180° delivery tube to a 3.636 N Sodium Hydroxide Titration Cartridge. Twist cartridge onto titrator body.
2. Flush out the delivery tube by turning the knob until a few drops of titrant are ejected from the tube. Wipe tip and reset counter to zero.
3. Take a water sample by filling a clean 100 mL graduated cylinder to the 100 mL mark. If possible allow the water to overflow the cylinder several times; then pour off the excess until the 100 mL level is reached. Pour into a clean 125 mL Erlenmeyer flask.
4. Add the contents of one Phenolphthalein Indicator Powder Pillow and swirl to mix.
5. Titrate sample while swirling the flask gently until a light pink color forms and persists for 30 seconds.
6. Read the number of digits used from the digital counter window. Multiply the reading by 2 to determine mg/L CO_2.

DISSOLVED OXYGEN TEST

1. Collect a water sample in a clean 300 mL glass stoppered BOD bottle by allowing the sample to overflow the bottle for two or three minutes. This ensures air bubbles are not trapped in the bottle.
2. Add the contents of one Manganous Sulfate Powder Pillow and one Alkaline Iodide-Azide Reagent Powder Pillow. Carefully insert the stopper so that no air is trapped in the bottle. Pour any excess water off the bottle rim and invert several times to mix. A flocculent precipitate will form which will be brownish-orange if dissolved oxygen is present or white if oxygen is absent.
3. Allow the sample to stand until the floc has settled, leaving the top half of the solution clear. Again, invert the bottle several times to mix and let stand until the upper half of the solution is clear.
4. Remove the stopper and add the contents of one Sulfamic Acid Powder Pillow. Replace the stopper, being careful not to trap any air bubbles in the bottle, and

invert several times to mix. Floc will dissolve, leaving a yellow color if dissolved oxygen is present.

5. Pour off exactly 100 mL of the prepared solution by filling the 100 mL graduated cylinder to the 100 mL mark.
6. Attach a clean 180° delivery tube to a 0.2000N Sodium Thiosulfate Titration Cartridge. Twist the cartridge onto the titrator body.
7. Titrate the 200 mL of prepared solution remaining in the BOD bottle with the Sodium Thiosulfate Titrant, 0.2000N, to a pale yellow color.
8. Add two droppersful of Starch Indicator Solution and swirl to mix. A blue color will develop.
9. Continue the titration until the solution changes from blue to colorless.
10. Read the number of digits from the digital counter window. Divide the reading by 100 to determine the concentration of dissolved oxygen (in mg/L).

HARDNESS TEST

1. Attach a clean 180° delivery tube to a 0.800M EDTA Titration Cartridge. Twist cartridge onto the titrator body.
2. Flush out the delivery tube by turning knob until a few drops of titrant are effected from the tube. Wipe tip and reset counter to zero.
3. Take a water sample by filling a clean 100 mL graduated cylinder to the 100 mL mark. Pour the sample into a clean 250 mL Erlenmeyer flask.
4. Using the 1 mL calibrated dropper, add 1 mL of Buffer Solution, Hardness 1, and swirl to mix.
5. Add the contents of one ManVer® 2 Hardness Indicator Powder Pillow and swirl to mix.
6. Titrate the sample with the EDTA standard solution while swirling the flask until the color changes from re to pure blue.
7. Read and record the concentration of total hardness (as mg/L $CaCO_3$).

pH TEST

1. Fill the two glass samples tubes to the 5 mL mark with water sample. It is imperative that the tube be rinsed completely free of any solutions that may have bee used previously.
2. Add six drops of Wide Range 4 pH Indicator Solution to one of the tubes and swirl to mix.
3. Insert the prepared sample in the right opening of the color comparator.
4. Insert the tube of untreated water sample in the left opening of the color comparator.
5. Hold the color comparator up to a light such as the sky, a window or a lamp and view through the two openings in the front. Rotate the color disc until a color match is obtained. Read the pH through the scale window.

REFERENCES

1. Hach Company, P.O. Box 389, Loveland, Colorado 80539

APPARATUS

1. Ecology Combination Test Kit
   Model AL-36DT
   Cat. No. 20638
   Cost $225
   Hach Company, P.O. Box 389, Loveland, Colorado 80539
   Telephone 303-669-3050

ADDITIONAL LAB - Utilizing the above tests.

PHOTOSYNTHESIS AND CELLULAR RESPIRATION

INTRODUCTION:

This lab will utilize the dissolved oxygen and carbon dioxide tests in the above Hach kit. All materials necessary for at least 20 tests come with the kit. It will allow students to measure the amount of O_2 and CO_2 in water samples containing algae after exposing them to light and no light situations. Since there is only one digital titrator per test kit, I would advise purchasing one test kit per group or one digital titrator per group along the chemicals needed.

MATERIALS: per student group

Nonconsumables	
Digital Titrator	1
100 mL graduated cylinder	1
300 mL glass stoppered BOD bottle	1
180° delivery tube	2
Goggles	1 per student
1000 mL beakers	2
Light source	1
Celsius thermometer	1
Consumables	
3.636N Sodium Hydroxide Titration Cartridge	1 (used for 20 tests)
Phenolphthalein Indicator Powder Pillow	1
Manganous Sulfate Powder Pillow	1
Alkaline Iodide-Azide Reagent Powder Pillow	1
Sulfamic Acid Powder Pillow	1
0.2000N Sodium Thiosulfate Titration Cartridge	1 (used for 20 tests)
Starch Indicator Solution	1 (used for 20 tests)
Nonchlorinated well water or boiled pond water at room temperature	1000 mL
Fresh water algae	

PROCEDURE

1. Fill each of 2 1000 mL beakers with 500 mL of well water
2. Place the same amount of fresh water algae in each one
3. Place one of the beakers under a light source but not close enough to affect the temperature
4. Place the other beaker n a dark cabinet or some other dark place but as near as possible to the same temperature as the first
5. Make another set up exactly like the ones above but without algae and place one in the light and one in the dark. (For economic reasons, only one of these setups needs to be made per class.)
6. Leave both over night
7. The next day, take the temperature of each setup and record it.
8. Test each setup for carbon dioxide and dissolved oxygen including the ones without algae. (The ones without algae may be done by the teacher for the class.)
9. Record your results.
10. If time permits, record the data from other groups in the class.
11. Make a data table and record the results.
12. Graph your results.
13. Draw conclusions.

TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME: Roy Darville

INTERNSHIP: Texas Parks & Wildlife Department - GIS
Austin, Texas

SCHOOL: East Texas Baptist University

PRIMARY SUBJECT: Biology

ACTIVITIES:

SUMMARY:

RESOURCES:

TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME: Becky Gullett

INTERNSHIP: Texas Parks & Wildlife Department - GIS
Austin, Texas

SCHOOL: Panola College

PRIMARY SUBJECT: Science

ACTIVITIES:

SUMMARY:

RESOURCES:

TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME: Kathy Jackson

INTERNSHIP:
Texas Parks & Wildlife
Endangered Resources Branch
Austin, Texas

SCHOOL:
Barton Creek Elementary
Austin, Texas

PRIMARY SUBJECT: Elementary

ACTIVITIES: A Resources Book for elementary school children to learn about endangered species in Texas.

SUMMARY: This book was designed to to insure an opportunity for students to learn about anamils and plants is such a way as to create an appreciation for the ecosystems of Texas.

RESOURCES:
Linda Kissock
Texas Parks & Wildlife
Endangered Resources Branch
3000 IH-35S., Suite 100
Austin, Texas 78704
512-448-4311
800-792-1112

TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME: Kathy Jackson

INTERNSHIP: Texas Parks & Wildlife Endangered Resources Branch
Austin, Texas

SCHOOL: Barton Creek Elementary, Austin

PRIMARY SUBJECT: Elementary

OBJECTIVE: To produce an independent activity book on the endangered species of Texas. It was the hope of the branch to create a document to insure an opportunity for students to learn about animals and plants in such a way as to create an appreciation for the ecosystems of Texas and man's involvement in the protection of these vulnerable systems in Texas and the world at large.

FORMAT OF BOOK: The book was designed to begin with an animal that is now extirpated in Texas and move through several endangered animals and plants relative to specific regions in the state. Then to finalize the book with an animal that has been a successful "come back" story through the recovery efforts of wildlife officials, scientists, and interested parties.

THE PLAN FOR EACH MODULE PER REGION OF TEXAS HAD A SPECIAL AND REPETITIVE DESIGN TO VISUALLY SUPPORT CLARITY AND SIMPLICITY FOR THE ELEMENTARY CLASSROOM.

This composition included an organized report using three basic components:

- The threat to the species
- A true story to create an emotional appeal to the reader
- One or two exercises that might range from an artistic/hands-on approach to a more critical or higher level thinking activity.

ANIMAL/PLANTS COVERED IN THE ACTIVITY BOOK INCLUDE:

A. Black-Footed Ferret
B. The Red Cockaded Woodpecker / The Trailing Phlox
C. The Greater Long-Nosed Bat
D. The Golden-Cheeked Warbler / The Black-Capped Vireo /
    The Texas Snowbell
E. The Peregrine Falcon
F. The Houston Toad / Large Fruited Sand Verbena
G. The Ocelot
H. The Whooping Crane

The Endangered Resources Branch had envisioned an Endangered Species Activity Book that could be done independently by the students of Texas. We hope that we have achieved this goal as well as making this booklet an incredibly interesting and accountable teaching tool for the teachers in the state.

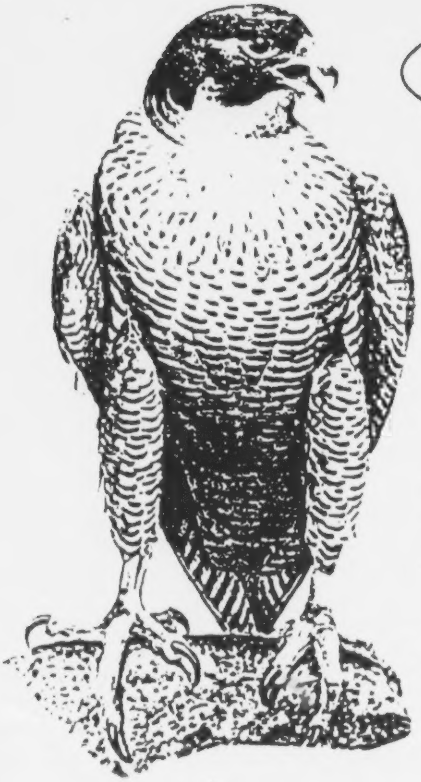
Essential Elements are listed in the book and can be used as a vehicle for TAAS Objectives as well.

AN EXAMPLE OF ONE ENDANGERED ANIMAL MODULE ACTIVITY BOOK IS ATTACHED FOR REVIEW.

You Can Receive This Book By Writing:

THE TEXAS PARKS AND WILDLIFE
ENDANGERED RESOURCES BRANCH
LINDA KISSOCK
3000 IH-35 S., SUITE 100
AUSTIN, TEXAS 78704

800-792-1112
512-448-4311



THE PEREGRINE FALCON HAS NOT ONLY FACED THE THREATS OF HABITAT LOSS AND HUMAN DISTURBANCE, IT IS ALSO A VICTIM OF THE WIDESPREAD USE OF **DDT** (A PESTICIDE).

THE FALCON TRUE STORY

AS YOU'VE LEARNED FROM YOUR SCIENCE CLASSES, PESTICIDES ON THE GROUND ENTER THE FOOD CHAIN.

SO WHEN THE FALCON EATS ITS DINNER, HE MAY BE EATING PESTICIDE THAT IS IN THE FATTY TISSUE OF AN ANIMAL THAT PROBABLY ATE SOME PLANTS COVERED WITH THIS CHEMICAL.

FALCON → BLACKBIRD → SEEDS → PLANTS, SOIL, AND WATER CONTAMINATED WITH **DDT**.

COLOR CUES: THE FALCON IS BLUISH GRAY WITH A BLACK CAP (LIKE A HELMET)AND A BLACK MARK BELOW THE EYE . THE BEAK IS BLUE .THE THROAT AND UNDERPARTS OF THE BIRD ARE WHITE AND SCATTERED WITH BLACK STREAKS. THE END OF THE TAIL FEATHERS ARE TIPPED IN LIGHT YELLOW BROWN. THE LEGS AND FEET ARE YELLOW WITH BLUISH BLACK TALONS (CLAWS).

ALTHOUGH EATING THE CONTAMINATED FOOD SOMETIMES CAUSES DEATH, **USUALLY** IT AFFECTS THE BIRD BY MAKING THEM UNABLE TO LAY EGGS OR TAKE PROPER CARE OF THEIR CHICKS.

BIRDS CONTAMINATED WITH *DDT* (A PESTICIDE USED TO KILL INSECTS ON FARM CROPS) PRODUCE EGGS WITH **SHELLS SO THIN** THAT THEY BREAK WHEN THE FALCON SITS ON THEM DURING NESTING. THE FALCON NESTS IN HIGH PLACES LIKE MOUNTAIN LEDGES AND CLIFFS.

HELP ARRIVES!

DDT WAS BANNED IN THE U.S. IN 1972. BY 1975 ONLY ABOUT 324 PAIRS OF BREEDING FALCONS REMAINED IN NORTH AMERICA.

TODAY, DUE TO THE HELP AND PROTECTION THAT *MAN* HAS OFFERED AND THE DECREASE OF DDT IN THE FOOD CHAIN, PEREGRINE FALCONS ARE REPRODUCING WELL THROUGH OUT MOST OF NORTH AMERICA.

IN TEXAS, WE NEED TO PROTECT BREEDING HABITAT IN THE WESTERN PART OF THE STATE. SINCE HUMAN DISTURBANCE CAN BE A SERIOUS THREAT TO THE FALCON. PARKS SUCH AS BIG BEND NATIONAL PARK HAVE VISITATION RULES DURING NESTING SEASON.

YOU CAN DO YOU PART BY FOLLOWING LABEL DIRECTIIONS ON HOW TO PROPERLY USE AND DISPOSE OF CHEMICALS AND THEIR CONTAINERS. THIS EFFORT WILL HELP TO KEEP HARMFUL CHEMICALS OUT OF THE FOOD CHAIN.

FOOD CHAIN DRAWING:

DRAW YOUR OWN **FOOD CHAIN** FOR ANOTHER BIRD OF PREY

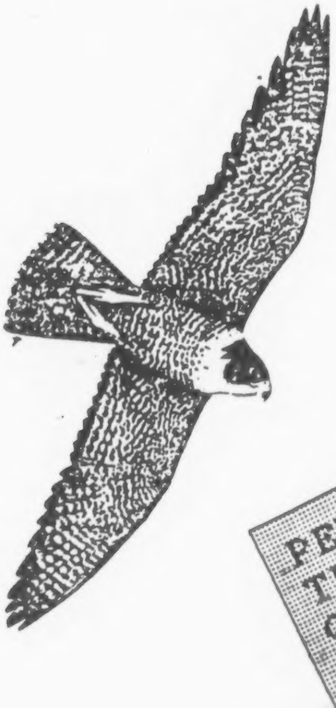
USE A FISH, A BALD EAGLE, A LEAF, AN INSECT

YOU CAN RECOGNIZE THIS FALCON IN FLIGHT BY LOOKING FOR THEIR "BLACK HELMET".

AN INCREDIBLE HUNTER-----

THE PEREGRINE FALCON IS A BIRD OF PREY. IT LIVES BY HUNTING OTHER BIRDS.

THE FALCON PREYS ON SMALL BIRDS LIKE SWALLOWS, JAYS, AND BLACKBIRDS. WHEN HUNTING, THE PEREGRINE RISES TO GREAT HEIGHTS, THEN GOES INTO A STEEP POWER DIVE CALLED "THE STOOP". THE SPEED OF THE DIVE HAS BEEN MEASURED AT 180 MILES PER HOUR (RACE CAR DRIVING SPEED). FALCONS STRIKE THEIR PREY AT SUCH GREAT SPEED THAT THE PREY IS OFTEN KILLED INSTANTLY JUST BY THE FORCE OF THE BLOW FROM THE FALCON'S TALONS(CLAWS).



PEREGRINES ARE EXCELLENT FLYERS! THEY CAN FLY AT A SPEED IN EXCESS OF 60 MILES PER HOUR.(AS FAST AS YOU DRIVE ON THE HIGHWAY)

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FALCON ACTIVITY ONE

A FALCON STORY FRAME

TEST YOUR COMPREHENSION BY FILLING IN THE STORY FRAME. YOU MAY HAVE TO GO BACK AND REREAD THE INFOMATION ABOUT THE FALCON.

1. **I HAVE A BLACK HELMET AND I AM A GREAT FLYER!**

I AM CALLED A

____

____

2

I AM A BIRD OF PREY.
I EAT...

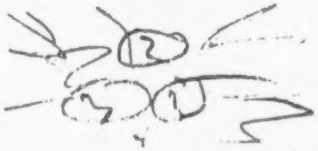
1. ____________
2. ____________
3. ____________

DRAW AN EXAMPLE OF FALCON PREY HERE!

3. ______IS A CHEMICAL THAT HAS ENTERED THE FOOD CHAIN

DRAW A FALCON FOOD CHAIN

4. THIS CHEMICAL CAUSED ME TO BREAK MY OWN EGGS, THE SHELLS WERE SO ____________.

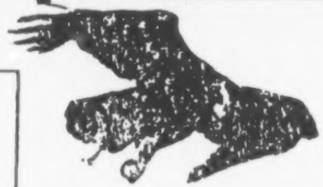


5.

DEAR FRIENDS,

THANKS SO MUCH FOR READING MY STORY! I'M PRETTY UNIQUE AREN'T I?

SINCERELY,
PERRY
PEREGRINE



WRITE YOUR FAVORITE FALCON FACT HERE!

____

____

____

____

GRAPHING POLL

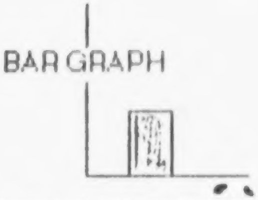
NOW THAT YOU HAVE READ THE MATERIAL ABOUT THE FALCON, TEST THE TRIVIA LEVEL OF FRIENDS AND FAMILY.

TAKE A TRIVIA POLL- ASK PEOPLE YOU KNOW IF THEY CAN GUESS THE RIGHT SPEED OF A FALCON "STOOP".

STEP 1. USE THE FORM AT THE BOTTOM TO RECORD YOUR INTERVIEW RESULTS. SHADE IN A BOX FOR EACH CHOSEN SPEED.

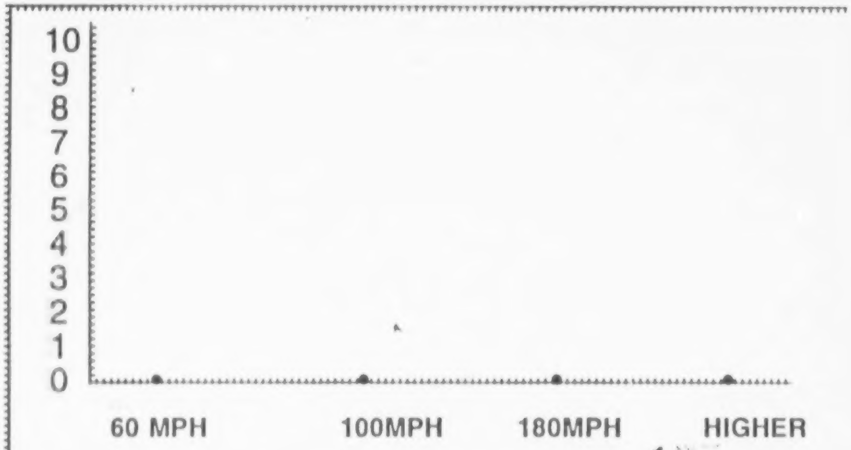
STEP 2. BE SURE TO EXPLAIN TO THE PARTICIPANTS WHAT A "STOOP "IS.I

STEP 3. AFTER YOU HAVE INTERVIEWED THE PARTICIPANTS AND ASKED THEM WHICH SPEED THEY WOULD GUESS THAT A FALCON COULD POSSIBLY MAKE A DIVE TO CATCH PREY, RECORD YOUR INFORMATION ON THE GRAPH.
YOU MAY NEED AN ADULT TO HELP YOU CREATE A BAR GRAPH.



(ABOUT TEN PEOPLE)

	PARTICIPANTS	SPEED 60MPH	SPEED 100MPH	SPEED 180MPH	HIGHER SPEED



Texas Alliance

TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME: Steve Krupp

INTERNSHIP: Texas Parks and Wildlife Department
Resource Protection Division
Environmental Contaminants Lab

"Interactive Roles of TPWD Programs, Career Paths and Students"

SCHOOL: Dripping Springs High School,
Dripping Springs, Texas

PRIMARY SUBJECTS: Physical Science, Chemistry, Environmental Science and Biology II

ACTIVITIES: Developing a slide presentation of the interactive roles of the Environmental Contaminants Lab, the Freshwater Studies Group and the A.E. Woods Fish Hatchery Lab within TPWD for presentations to schools and public interest groups

Producing graphics that illustrate the processes of analytical instruments in a laboratory

Developing lab demonstrations that correlate with the graphics illustrations

Organizing field trips that reinforce the technical concepts and careers in the sciences

SUMMARY:

There is an enormous increase in career paths in the sciences in both industry and public agencies. New analytical laboratories are opening at all federal, state and local levels, where before these analytical needs were contracted to universities and existing private labs. Today's students can find out early what opportunities these careers provide.

The purpose of this curriculum is to give teachers, students and TPWD scientists a presentation tool with which to view and demonstrate current analytical methods.

Opportunity to visit TPWD laboratory sites, university research facilities and wildlife habitat areas through field trips and guest presentations is the linkage between students, their teachers and their careers. Field trips simultaneously motivate students and assure their first hand interaction with career activities. Students can become involved environmental peer leaders and make knowledgeable educational and career decisions.

RESOURCES:

Mr. Ismael (Smiley) Nava
Texas Parks and Wildlife Department
Program Leader
Contaminant Assessment Program
Resource Protection Division
4200 Smith School Rd.
Austin Texas, 78744

Dr. David Klein
Texas Parks and Wildlife Department
Director: Environmental Contaminants Lab
Resource Protection Division
A.E. Woods Fish Hatchery
505 Staples Rd.
San Marcos, Texas

Becky Walch
Texas Parks and Wildlife Department
Conservation Scientist: Environmental
Contaminants Lab
Resource Protection Division
A.E. Woods Fish Hatchery
San Marcos, Texas

Joe Guerrero
Student Intern: Southwest Texas State
University/Texas Parks and Wildlife Dept.
Environmental Contaminants Lab
Scientist, Edwards Aquifer Research and Data
Center: Southwest Texas State University
San Marcos, Texas

OBJECTIVES AND ACTIVITIES FOR "Interactive Roles of TPWD Programs, Career Paths and Students"

1. To report or discuss current articles in newspapers, magazines or professional journals that describe current analytical issues in an environmental context.
2. To perform on sit analysis of water quality in existing waterwaysor in runoff water, or through streamtable models.
3. To view a slide presentation of TPWD field and lab activities to help orient students to the data gathering techniques of career scientists.
4. To perform demonstrations that model the basic separation techniques on which modern analytical instruments are based.
5. To make site visits to the TPWD Environmental Contaminants lab and the forensic lab at the A.E.Woods Fish Hatchery.
6. To make site visits to The Edwards Aquifer Research and Data Center at Southwest Texas State University.
7. To attend a presentation by TPWD scientists addressing contaminant analysis of habitat assessment.
8. To participate in a continuing survey of a local natural area and to make a site visit to a TPWD "natural classroom" or outdoor education facility.

ACTIVITY 1

Students begin and continue a survey of a local natural area to include:

a) perimeters
b) vegetative survey
c) elevation contours
d) soil type - moisture levels
e) shade / sun levels

Objectives: 1,2,8

These ongoing measurements will be averaged by the students and mapped, then put on transparency. An overlay technique, similar to Geographical Information Systems (GIS) will be used to show composite effects of all the variables together.

The centerpiece activity will be a field trip to Pedernales Falls State Park or other developed outdoor education facility. Students will share experiences with the staff naturalist and develop their own "expert" manual or key for that natural area.

An extending activity will be for students to continue survey activities and publish "expert" manuals or vegetative keys for local parks to showcase their learning within their community.

ACTIVITY 2

Students view introductory slide presentations of TPWD workers and scientists, demonstrating the interrelationship of Parks and Wildlife departments with each other and with other agencies and universities.

Objectives: 3,4,5

Among the introductory slides are graphics that prepare the students for understanding the instruments they will see during their field trips. Often the technical nature of analytic instruments limits students to a "black box" perception of input output with little understanding of the separation processes.

These illustrations give students visual impressions of the mechanisms of attraction that cause separation used in gas chromatography, gel permeation chromatography, and mass spectroscopy and other analytical processes.

Proof sets of the slides printed by xerox will be available for students to record information during the slide presentation and these can be kept by the student for use during and after the field trip to the TPWD labs.

ACTIVITY 3

Students attend follow up presentation by TPWD scientists in environmental contaminants and freshwater studies.

Objectives: 5 and 7

Either preceding or following the student's site visit to the Environmental Contaminants Lab, a TPWD chemist from the lab and a biologist from the Freshwater Studies group wiil be invited to make a presentaion to Dripping Springs High School students. The presentation serves to familiarize the students with the overall activities and interrelationships of these groups and the career pathways of the scientists who perform them.

I would like to express my appreciation in advance to Ismael (Smiley) Nava, Dr. David Klein, Becky Walch, Joe Guerrero, Gordon Linam, Cindy Hobson and Jack Ralph for their willingness to participate in this aspect of the curriculum plan. They will bring a wide variety of experience and presentation techniques to our school.

ACTIVITY 4

Students make site visits to the TPWD A.E. Woods Fish Hatchery.

Objectives: 4,5,6

The cornerpiece of the instructional presentations by the teacher and the presentations by TPWD scientists is the student's site visit to the A.E. Woods facility. The students groups will be subdivided into smaller groups to rotate through three activities.

1. The students will observe and visit chemists at the Environmental Contaminants Lab. The preparation of samples can be demonstrated in the prep room and the need for scientific controls and QA-QC can be explained there. Additionaly students can observe and question the use of technology through instruments used in the analysis of inorganic and organic materials . The following apparati can be seen in operation

The atomic absorption spectrophotometer - used in metals analysis

The high pressure liquid chromatograph - used in gel permeation chromatography for the separation of fats and organic pesticides

gas chromatograph / Electon Capture Device - used to separate volatiles and organic chlorine pesticides for graphing and identification

mass spectrometer - 3rd dimension analytical backup for gas chromatograph

The students will already have seen and discussed the operation of these instruments through the introductory slide presentation in ACTIVITY 2 as preparation for this visit.

2. The students will visit and observe the operation of the fish hatchery and the forensic fisheries lab. There they will see the management of fish specie production, typing and stocking on a large scale. The forensics lab will allow students to observe and relate modern techniques similar to electrophoresis, currently used in human forensics, applied to identify game and other wildlife. Even stories of courtroom drama can be heard telling of the use of these techniques by

TPWD personnel. Also egg extraction, matting and fish population health management techniques can be seen at the forensic fisheries lab.

ACTIVITY 5

Students continue related environmental education through ongoing projects such as the Colorado River Watch Network or individual six weeks projects.

Objectives: 1,2,8

Students who are inclined toward enjoying the outdoors and enjoying the applications of environmental chemistry can continue to see their work and interests related to ongoing studies. The Colorado River Watch Network is a program sponsored by the LCRA that involves student and citizen groups in the monitoring of water quality within all tributaries of the Colorado River watershed. The CRWN provides training and equipment to these groups for measuring physical, chemical and biological water quality parameters including total dissolved and suspended solids, pH, temperature, dissolved oxygen, phosphates, nitrates, biological oxygen demand, and animal and macrophyte indicator species identification.

Students meet with their leader on a bi-weekly basis to measure water standards at a chosen research site. The data are then reported to the LCRA for analysis of water quality throughout the watershed. The very same field trips proposed within this Curriculum Project serve as extensions for the River Watch group's activities.

TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME: Liz Troub
Dixie Smith

INTERNSHIP: Texas Parks & Wildlife / Star Enterprises
Spring, Texas

SCHOOL: Dueitt Middle School
Spring, Texas

PRIMARY SUBJECT: Middle School Science

ACTIVITIES:

- Nature Trail Guide and Student Packet
- Aquatic Study Project--Detecting Water Pollution

SUMMARY: To provide teachers and students with field activities for environmental studies.

RESOURCES: See Attached

TTIP
CURRICULUM IMPLEMENTATION PLAN
ABSTRACT

NAMES: Liz Troub
Dixie Smith

INTERNSHIP: Star Enterprise/Texas Parks and Wildlife

SCHOOL: Dueitt Middle School

PRIMARY SUBJECT: Middle School Science

ACTIVITIES: Nature Trail Guide and Student Packet
Aquatic Study Project--Detecting Water Pollution
Appendix--Environmental Education Resources

SUMMARY: The purpose of this curriculum implementation plan is to provide teachers and students with field activities for environmental studies. Our internship was unique in that it enabled us to work at our school site with Texas Parks and Wildlife to develop a nature study area which was made possible through a grant by Star Enterprise. The above activities will be utilized for environmental education in this outdoor natural area. The appendix includes sources of other environmental educational materials designed for field work or classroom/laboratory settings.

RESOURCES: Texas Parks and Wildlife Department
Sheldon Lake State Park
14320 Garrett Road
Houston, Texas 77044
(713) 456-9350
Diana Foss, Urban Biologist
Chuck Kowaleski, Urban Biologist

Mercer Arboretum
22306 Aldine Westfield Road
Humble, Texas 77338
(713) 443-8731
Greg Weilander, Botanist
Don Olhausen, Naturalist
Linda Moates, Education Coordinator

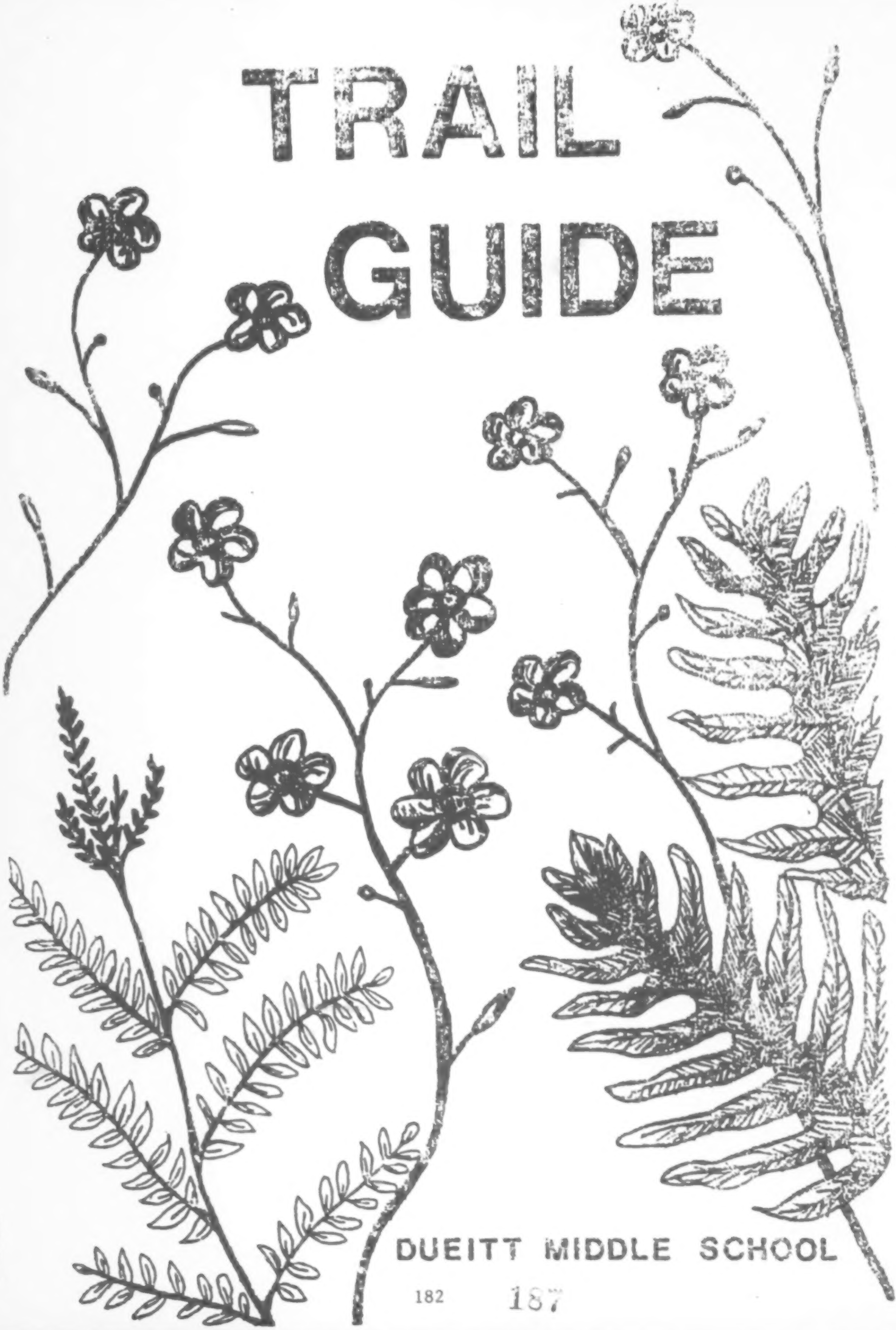
Jesse H. Jones Park
20634 Kenswick Drive
Humble Texas 77338
(713) 446-8588
Carmine Stahl, Naturalist
Darlene Floyd, Horticulturist

United States Department of Agriculture
Soil Conservation Service
Rosenberg Field Office
908 Frost Street
Rosenberg, Texas
(713) 342-8582
Eddie Garcia, Civil Engineering Technician

Houston Field Office
16151 Cairnway
Houston, Texas 77084
(713) 855-8716
David Myers, SCS Agent

Houston Arboretum And Nature Center
4501 Woodway
Houston, Texas 77024
(713) 681-8433
Pat Marks, Director
Don Gray, Volunteer

TRAIL GUIDE



DUEITT MIDDLE SCHOOL

Introduction

During the 1982-83 school year, the Spring Independent School District Board of Trustees gave approval to and funding for Teacher Initiative Projects (TIP). This special program was developed to encourage, facilitate, recognize, and reward teachers for creative and well designed instructional approaches to teaching. Dueitt Middle School science teachers, Miss Liz Troub and Mrs. Dixie Smith, submitted an application for a TIP award for developing an outdoor laboratory and natural area. It was felt that a natural outdoor setting would provide a unique and dynamic way of teaching environmental and ecological concepts and practices, as well as providing a place for the study and observation of living organisms in their natural habitat. The application received approval.

Development was begun in the fall of 1983. Location of the trail was determined from an inventory of plants and trees. Plans were drawn for a large group seating area to be located in a small grove of trees at the edge of the wooded lot. The seating area and a foot bridge were constructed by Mr. Rick Martinez and his industrial arts classes. The science team, science students, and administration all assisted in trail clearing. Markers were placed along the trail to identify specific areas of interest. Thus, this trail guide was written to explain what could be observed at each trail marker.

Along with the trail guide and other activities developed by science teachers, the outdoor laboratory and natural area is being utilized for science instruction.

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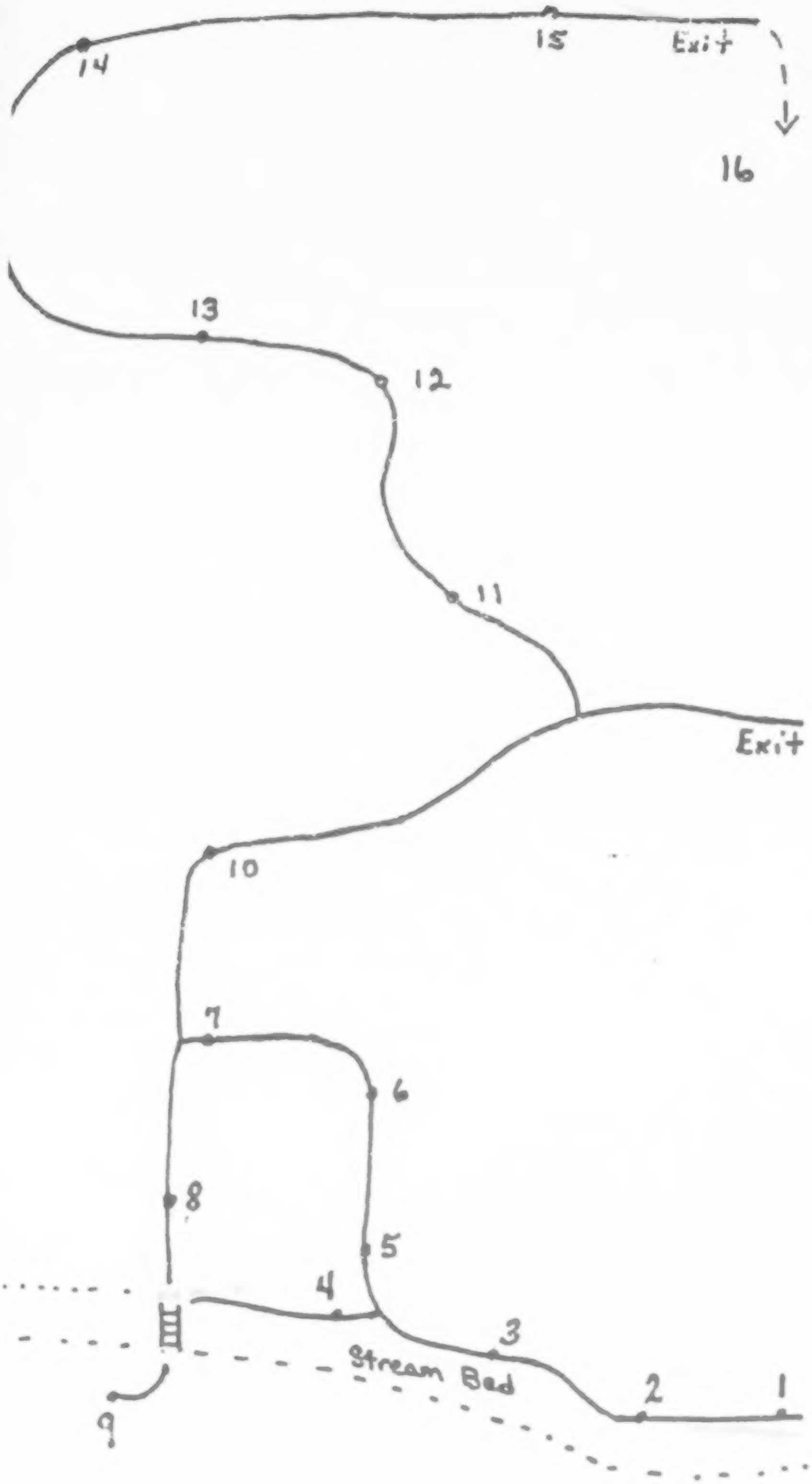
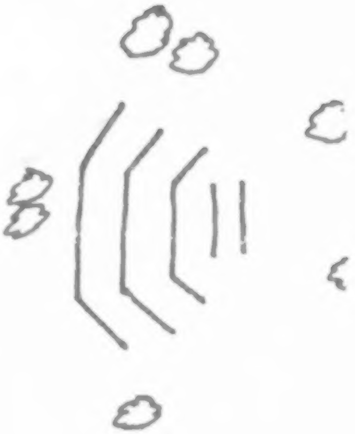
Trail Map


14
15
Exit
16
13
12
11
Exit
10
7
6
8
5
4
3
Stream Bed
2
1
9



TRAIL GUIDE

Marker No.

1 The hollow log seen at this stop provides a home for many woodland animals such as squirrels, rabbits, opossums and raccoons. Spiders and insects are abundant here as well. Also, notice the fungi and lichens growing on the outer bark of the log. Flame-leaf sumac (Rhus copallina), blackberry and dew berry bushes, and a variety of other small tree seedlings and shrubs have begun to grow up around the logs piled here.

2 To the right of the marker and growing along the stream is a Rusty Blackhaw Viburnum (Viburnum rufidulum). This particular tree is thought to be one of the larger ones of this kind found in Harris County. The tree's unusual shape results from its irregular branching. Deeply grooved bark and dark green leathery leaves with shiny upper surfaces are characteristic of the Rusty Blackhaw. White flowers blossom in early spring. A bluish-black fruit, called a drupe, ripens during the summer months. The fruit hangs in drooping clusters providing food for birds and large mammals such as deer.

The woody vine growing up the oak tree to the left of the Rusty Blackhaw is Poison Ivy (Toxicodendron radicans). It covers much of the ground here and throughout the woodland. Learn to recognize this poisonous vine by its three leaves. The poisonous oil of this ivy, called "toxicodendrol" causes a skin irritation, itching and burning. Although a nuisance to man, the white berry-like fruit, serves as a food source for many birds. Another vine seen growing in this area is Virginia Creeper (Parthenocissus quinquefolia). It has five leaflets, glossy and dark green in color. Unlike poison ivy, it is not poisonous.

3 The decomposing log seen here plays an important role in the woodland ecosystem. Although dead now, the log was once a living tree. As a living tree, it used the sun's light energy to make food for its growth. Stored in the wood of the tree is food energy. Decomposers like micro-organisms, fungi, centipedes, insects and worms get their energy from this wood. As decomposers breakdown the log, nutrients are returned to the soil to be used by other living things.

On the upper surface of the decomposing log, a fern can be seen growing. This is the Resurrection Fern (Polypodium polypodioides). During dry periods, the fern shrivels up, turning brown and appearing dead. After it rains and moisture is plentiful again, the fern greens and unfolds.

To the left of the trail and growing along the stream is a Black Cherry (Prunus serotina). The tree is difficult to see, but if one looks over the top of the yaupon or through an opening between the three large trees on the left side of the trail, it is visible. The small tree has a gray trunk and reddish colored branches. Its shiny green leaves are oval shaped. In the spring the tree will have a white blossom and later in the summer it will bear an edible fruit black in color. After preparation, the bark of the tree is used in cough syrup and the fruit is used as a flavoring extract as well as food for man. Birds, raccoons, opossums, squirrels and rabbits feed on the fruit also. The leaves are considered to be poisonous to livestock. The wood of the tree is used in furniture and cabinet making. Printer's blocks, veneer, patterns, paneling, interior trim, handles, wooden bowls and utensils, toys and scientific instruments are also made of the wood of the Black Cherry.

4 Just as the trail branches to the right and before reaching this marker, you may have observed two small trees growing along the stream. These are Common Hackberry (Celtis occidentalis). The Common Hackberry is characterized by smooth, gray bark, greenish twigs and leaves with jagged edges and the feel of sandpaper. An orange-red drupe which turns dark purple is produced by the tree. This fruit is eaten by several kinds of birds and was at one time eaten by Indians.

On the bank of the stream a Little-Hip Hawthorn (Crataegus spathulata) is growing. It can be recognized by its reddish-brown to gray bark that flakes off. The trunk of the tree is smooth but the branches have slender sharp spines 1 to 1 1/2 inches long. Leaves of the tree are small and dark green. Blooming in the spring is a white flower and appearing in the fall is a fleshy bright red fruit called a pome.

Most of the time only a dry stream bed is present here. But after rains, runoff from the surrounding land, collects in the stream and is carried to the bayou beyond the woodland. Look for ripple marks on the bottom of the stream and how debris like branches and limbs scrape and erode the banks of the stream. Leaves, grasses, twigs and sediment (pebbles, sand, clay, and silt) are also part of the load carried by the stream. Observe how the sediment sorts itself out by size and where it is deposited along the curves in the stream.

Ahead and to the right of the marker, a small, very young sapling has begun to grow. It is a Common Persimmon (Diospyros virginiana). At maturity, the tree will be fairly small and have an irregular shape due to an unusual branching pattern. The leaves appear dark green on the upper surface, but a pale green underneath, and have a soft or fuzzy texture. Ripening in the fall are yellow to orange to red berries that have a very high sugar content. Not only is the fruit eaten by many species of birds, skunks, raccoons, squirrels and deer, but it also was used by early settlers in cooking. This tree grows in nearly any kind of soil, especially here in the South making it suitable to plant for erosion control. However, it is often attacked by diseases caused by insects and fungus.

BEST COPY AVAILABLE

5 The tree you see here is easily recognized by the spiny bumps on its trunk. Indians and early settlers of the region used the spines, bark and twigs from this tree to dull the pain of toothaches and teething and hence the tree came to be known as a Toothache Tree (*Zanthoxylum clava-herculis*). Another common name for this tree is Hercules Club. Several kinds of birds feed on the fruit of the tree.

6 The mitten-shaped leaves and reddish-brown to gray bark with a distinct aroma help identify the trees here as Sassafras (*Sassafras albidum*). The oil of the sassafras has been used for making many things including antiseptics, disinfectants, and tea. The dried leaves have been used as a flavoring for soups.

To the right of the trail is a small, scraggly shrub known as Elbow Wood or Downy Forestiera (*Forestiera pubescans*). It grows in moist, rich soils near streams. Although the shrub has no value to man for landscaping, it can be planted to provide cover for wildlife and for control of erosion. Its value as wildlife cover is very evident here. Birds (cardinals, chicadees, and bluejays) are frequently seen perched or nesting in the shrubbery in this area.

7 At this stop, three large trees are present. These are the Post Oak (*Quercus stellata*) to the right of the trail, the Mockernut Hickory (*Carya tomentosa*), and Sweet Gum (*Liquidambar styraciflua*) to the left of the trail. Look carefully and you may see squirrels scurrying along the ground or up the trunks of the trees here.

The Post Oak has a simple, dark green leaf with rounded lobes. The fruit of the tree, the acorn, is eaten by deer, squirrels and birds. The wood is used for lumber, fence posts, railroad ties, furniture and firewood.

The Mockernut Hickory can be identified by its compound leaf consisting of 5-9 leaflets (usually 7). The tree produces an edible nut in the fall. This nut was used by Indians to make vegetable oil. They would crush the nut, put it in hot water, then skim the oil off the surface of the water as it rose to the top. The nut is also a source of food for woodland animals and birds.

Next to the Mockernut Hickory is a Sweet Gum tree. It can be recognized by its simple, glossy leaf with 3-7 pointed lobes and its fruit which is a spiny round ball. In the fall the leaves will turn to shades of red or yellow. Several kinds of birds feed upon the fruit. Over the years the tree has had multiple uses. The gum has been used in medicines and as a perfuming agent in soaps. The wood is used for flooring and in making furniture, cabinets, boxes, barrels and musical instruments.

8 On the curve to the right of the trail is a dead tree. It is a very important part of the woodland ecosystem. Notice the holes pecked out by birds and bored out by insects. Dead trees provide homes for forest animals and birds. The dead wood serves as food for insects which in turn are a plentiful source of food for birds.

9 Across the bridge and to the right an oak tree, toppled during the May, 1983 tornado, has fallen across the stream. Notice the Spanish Moss (Tillandsia usneoides) hanging from the branches. Despite its name, the plant is not really a moss at all; it is one of the plants in the pineapple family. The Spanish Moss is also an example of an epiphyte -- a plant that grows on another plant (host) without bringing harm to that plant. The Spanish Moss by hanging from tree branches more easily obtains its needed food and moisture from the air.

Just to the left of the toppled tree is a Dwarf Palmetto (Sabal minor). This kind of palm has no trunk. Its pale green, fanlike leaves grow from an underground root.

10 As you come to this marker, an opening in the woodland is evident. This area receives much more sunlight than previous stops along the trail. Growing here are sun-tolerant plants such as the blackberry, American Beauty Berry, and tree seedlings including loblolly pine, sweet gum, and a few oaks.

There are many species of blackberries and dewberries (Rhubus sp.) native to Texas woodlands. They are difficult to differentiate. Some of the bramble or shrubby plants growing here have three leaves and others have five leaves. Some canes grow close to the ground and others grow upright then arch over. They may be six feet or more in length and usually are deeply furrowed and covered with prickles. In the spring, a white flower blooms filling the air with a sweet fragrance. Insect pollinators, such as bees and butterflies, are frequently seen moving from flower to flower. Later in the season, a plump sweetish but rather seedy fruit is produced in abundance. At first the fruit is red, then it turns black as it ripens. The fruit is eaten by both man and woodland inhabitants.

Intwined in the blackberries and dewberries is a woody vine known as Japanese Honeysuckle (Lonicera japonica). The bark of the vine is reddish-brown. The leaves are arranged opposite to one another in groups of four. The flower which is white, pink, or later becoming yellow is very fragrant making it popular for landscaping especially here in the Southern states. The vine was imported from Asia. Its successfulness has resulted in it becoming a troublesome weed.

To the left of the marker is a large shrub. This is the Chinese Privet (Ligustrum sinense). Its flowers are fragrant in the spring and its fruit is bluish-black. The leaves are small, oval shaped and arranged opposite to one another on the shrub's branches. The shrub is native to China and was imported to the United States, particularly the South, for use as ornamental hedges and shrubs.

11 At this stop, the five layers of a forest community, namely, the litter layer, herb layer, shrub layer, understory and canopy can be observed. On the forest floor, or litter layer, fallen leaves, pine needles and cones, nuts, twigs and branches are found. The herb layer consists of herbs or flowers like the woods violet, elephants foot, carolina horsenettle and Jerusalem Cherry. In the

shrub layer bushes and shrubs, such as the blackberry and American Beauty Berry grow. Yaupon, young pines and small trees like the persimmon and hawthorn make up the understory. Examples of large mature trees found in the canopy are oaks, sweet gums, winged elms and loblolly pines.

One particular tree growing here is the Net-Leaf Sugar Hackberry (Celtis laevigata var. reticulata). It is found to the right of the trail marker. The tree is more accurately a large shrub, never growing very tall. Its leaves are more slender and smoother along the edges than the Common Hackberry observed at an earlier stop. It too has an orange-red fruit which becomes black and is a source of food for some birds. Galls or hard-roundish growths, may be seen on the leaves, also.

12 The tree to the right of the marker is a Chinese Tallow-tree (Sapium sebiferum). This is generally a small tree with a simple leaf shaped like a spade and has a long, slender yellow-green flower. In the winter the leaves turn a deep red. The milky sap of the tree is poisonous. It is often used as an ornamental tree in landscaping. Here in the woodland the tallow tree is a foreign invader species. It grows where many native species will not and it often out competes the native species like sweet gum and oaks. Ahead and to the left, another Toothache Tree or Hercules-Club can be observed.

13 This area of the trail becomes very dense with thick undergrowth and receives much less sunlight than previous stops along the trail. To the left of the trail marker is a Possum-Haw Holly (Ilex decidua). Notice how the tree branches out from its base and its smooth, light colored bark. The tree drops its leaves in the fall but its orange-red fruit remains all winter making it an excellent choice in designing home and commercial landscapes. The fruit is a favorite of opossums, hence the name Possum-Haw. Several kinds of birds feed on the fruit, too.

At the right of the marker, a strangler vine, Alabama Supplejack or Rattan Vine (Berchemia scandens) can be seen wrapping itself around a Little-Hip Hawthorn. Observe how this smooth green vine has cut into this tree. This strangling action has been known to kill trees. The vine produces a bluish-black fruit on which many birds feed. Wicker baskets and furniture are often made from the vine and a natural dye can be made from the purple staining juice of the vine's fruit.

Another tree growing here is the Winged Elm (Ulmus alata). This particular tree here is very small but easily recognized by the soft, corky "wings" on its twigs and branches and sharply toothed, rough feeling leaves. The wood on this elm is used to make handles for tools like hammers, axes and shovels.

14 As you round the curve, another Toothache Tree or Hercules-Club comes into view to the left of the trail. To the left of this tree, one of the vines seen growing, is the Common Green Cat Briar (*Smilax rotundifolia*). This vine climbs by spirally coiled tendrils often forming tangled thickets. It is an evergreen with bright green or brown stems that bear spines. The leaves tend to be rather round but their shape can vary greatly. The fruit of the vine is black and seedy. It serves as a food source for birds, rabbits, opossums and raccoons.

On the right side of the trail, across from the marker and Toothache Tree, notice the absence of herbs and small bushes and shrubs growing in this area. The dense overhead canopy prevents sunlight from reaching these lower levels in the forest. The result is little or no growth at these lower levels. Carolina Snailseed (*Cocculus carolinus*), Mustang Grape (*Vitis candicans*), and Fox Grape (*Vitis labrusca*) are some of the vines growing on the trees in this area. The Carolina Snailseed vine is a slender, twining vine bearing bright red drupes or fruit in the fall. The Mustang Grape is a very hardy, strong vine that will grow 40 feet or more in length. The under surface of the leaves and young stems are covered with soft whitish hairs. Round black berries in clusters of 3-12 ripen in August and provide food for birds and other wildlife. The skin of the berry is tough and thick and tastes bitter so it has little food value for man. The Fox Grape is another strong growing vine. The lower leaf surfaces and twigs are covered with a rusty colored fuzz. Opposite each leaf is a forked tendril or flower cluster. Dull black to brownish, purple berries in clusters of not more than 20 ripen in late summer and through the fall. Birds and animals feed on the berry but its thick tough skin and musky taste make it undesirable as a food for man.

A large Post Oak stands to the right of the trail marker. As you can see, several large woody vines are growing up its trunk. One of these vines is the Alabama Supplejack that was pointed out at a previous stop along the trail. Another is a Saw Briar (*Smilax bona-nox*). This is a very stout spiny vine common in thickets like the area here. The leaves tend to be heart shaped and have tiny prickly spines. The fruit, a black berry, is eaten by birds.

15 You probably have noticed an abundance of one particular kind of shrub or small tree all along the trail. This shrub is the Yaupon Holly (*Ilex vomitoria*). It is an evergreen, thicket-forming shrub characteristic of the Big Thicket region of Texas. The small dark green leaves are shiny and oval shaped. Its bright red fruit and evergreen leaves make it popular for home landscape use. The fruit also serves as food for a variety of birds. Indians made a medicinal tea from the leaves of the shrub. This "brew" was known as the "Black Drink."

The large pines in this woodland are Loblolly Pines (Pinus taeda). The tree can be identified by its reddish-brown, rough and ridged bark and its leaves which consist of a cluster of three long (5-10 inches) slender three-sided needles. Its fruit is a reddish-brown cone 3-5 inches long. The wood of the Loblolly Pine is used for lumber, posts, pulp, barrels, boxes and firewood. Fire is the worst enemy of this tree. It weakens it, making it susceptible to attacks of southern pine bark beetles. This beetle is destroying many acres of southern pine forests.

Another shrub growing here and typical of thickets is the American Beauty Berry (Callicarpa americana). The shrub has a pale blue to pink or rose colored flower and a rose to purple or violet to blue fruit. The fruit is eaten by several kinds of birds, raccoons, opossums and fox.

16 The area marked here has been severely damaged by heavy machinery that was used to remove debris piled here from the May, 1983, tornado and Hurricane Alicia, August, 1983. In time the area will gradually grow back as it originally was. This change over time is called succession and occurs in observable stages. Currently the area is void of all vegetation on the ground surface. The first plants to grow here will be fast growing herbs, short-lived weeds and invader plants. On either side of the marker, Pepper-vine (Ampelopsis arborea), is beginning to take a foothold in the rich soil. This slender vine will climb or spread out over the ground. Its leaves are delicate and fern-like. The vine can be found growing in many places along the trail, especially near the stream. Eventually, bushes, shrubs and small seedlings will replace the grasses, weeds, herbs and invader plants. Softwoods, such as pine, will be the first trees to reforest the region. Gradually, deciduous trees will replace many of the pines and the mixed hardwood-pine forest will re-establish itself again.

On the margin of this cleared area and to the left of the marker, a very young Red Mulberry (Morus rubra) is growing next to a large oak tree. Sometimes it is very difficult to recognize a Red Mulberry by looking at its leaves. The leaves may differ greatly in appearance even on the same tree. Some leaves may have many lobes and other leaves only a few lobes. The fruit of the tree looks similar to a blackberry, red at first and becoming purplish-black. It is a favorite food of many birds and squirrels. Indians used the fibrous bark of the tree to make clothing.

Another Mockernut Hickory can be seen growing to the left of the Red Mulberry. The very large tree growing to the right of the trail marker, near the trail exit, is a Winged Elm.

PLANTS OF THE OUTDOOR LABORATORY AND NATURAL AREA

(Following is a list of trees, shrubs, vines, ferns, and herbaceous plants organized in order of appearance along the trail and as arranged in reference collection in notebook.)

TRAIL MARKER	SCIENTIFIC NAME	COMMON NAME
1	Rhus copallina	Flame-leaf Sumac
2	Viburnum rufidulum	Rusty Blackhaw Viburnum
	Toxicodendron radicans	Common Poison-ivy
	Parthenocissus quinquefolia	Virginia Creeper
3	Polypodium polypodiodes	Resurrection Fern
	Prunus serotina	Black Cherry
4	Celtis occidentalis	Common Hackberry
	Crataegus spathulata	Little-Hip Hawthorn
	Diospyros virginiana	Common Persimmon
5	Zanthoxylum clava-herculis	Toothache Tree
6	Sassafras albidum	Common Sassafras
	Forestiera pubescans	Elbow wood
7	Quercus stellata	Post Oak
	Carya tomentosa	Mockernut Hickory
	Liquidambar styraciflua	American Sweet Gum
9	Sabal minor	Dwarf Palmetto
	Tillandsia usneoides	Spanish Moss
10	Rubus sp.	Blackberry
	Rubus sp.	Dewberry
	Lonicera japonica	Japanese Honeysuckle
	Ligustrum sinense	Chinese Privet
11	Solanum carolinanum	Carolina Horsenettle
	Solanum psuedocapsicum	Jeruselum Cherry
	Celtis laevigata var. reticulata	Net-Leaf Sugar Hackberry
12	Sapium sebiferum	Chinese Tallow-tree
13	Ilex decidua	Possom-Haw Holly
	Berchemia scandens	Alabama Supplejack
	Ulmus alata	Winged Elm
14	Smilax rotundifolia	Common Green Cat Briar
	Cocculus carolinus	Carolina Snailseed
	Vitus candicans	Mustang Grape
	Vitus labrusca	Fox Grape
	Smilax bona-nox	Saw Greenbriar

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[illegible]	SCIENTIFIC NAME	COMMON NAME
13	*Ilex vomitoria*	Yaupon Holly
	Pinus taeda	Loblolly Pine
	Callicarpa americana	American Beauty-Berry
14	*Ampelopsis arborea*	Pepper-vine
	Morus rubra	Red Mulberry
ADJACENT SPECIES	*Sesbania drummondii*	Rattlebush
	Quercus falcata	Southern Red Oak
	Quercus nigra x Quercus obtusa	Water Oak x Diamondleaf Oak
	Quercus nigra x Quercus laurifolia	Water Oak x Laurel Oak
	Juglans microcarpa	Texas Black Walnut

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Spring Independent School District Administration and School Board and Dueitt Middle School PTO

PROJECT DESIGN

Dixie Smith and Liz Troub

SEATING AREA AND BRIDGE CONSTRUCTION

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TRAIL CLEARING

Dr. Jim Stapleton (Principal), Jerry Ellis (Assistant Principal), Dixie Smith, Liz Troub, Jim Carson, Mike Hudson, Jon Buchynsky (Science Team), and students

PLANT INVENTORY

John Koros (Mercer Arboretum) and Gary Levy (Wunsche Middle School)

PLANT IDENTIFICATION

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CONSULTANTS

Diane Cabiness (Mercer Arboretum), Larry Dreesen (Agricultural Extension Service), and Ed Smith

COVER DESIGN

Lori Schulman (Dueitt Art Student)

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TRAIL MARKER ONE

1. List three organisms that might use this hollow log for their habitat (home).

   a.

   b.

   c.

2. Using the magnifying glass as an aid, make a drawing of the shelf fungi and lichens growing on the log in the appropriate box below. Use map pencils to color the drawings.

SHELF FUNGI	LICHEN

TRAIL MARKER TWO

1. **Make a drawing of the leaves of the Rusty Blackhaw and the poison ivy plant in the appropriate box that follows. Carefully observe the outer edge of the leaves and the veins in the leaves and accurately illustrate. Use map pencils to color the drawings.**

RUSTY BLACKHAW

POISON IVY PLANT

TRAIL MARKER THREE

1. Make a drawing of the Resurrection Fern and the Virginia Creeper plant in the appropriate box below. Carefully observe the foliage of each plant and accurately illustrate. Use map pencils to color the drawings.

RESURRECTION FERN

VIRGINIA CREEPER

2. How does Virginia Creeper differ from Poison Ivy?

TRAIL MARKER FOUR

1. What evidence is there that the stream has eroded?

   a.

   b.

2. Name two things that have caused the stream to erode.

   a.

   b.

3. Name two kinds of sediment building up in the stream bed.

   a.

   b.

4. Make a drawing of a leaf of the Little-Hip Hawthorn and a section of the tree's trunk in the appropriate box below. Carefully observe the outer edges of the leaf and veins and the tree's bark and accurately illustrate. Use map pencils to color the drawings.

LITTLE-HIP HAWTHORN LEAF	LITTLE-HIP HAWTHORN TRUNK

TRAIL MARKER FIVE

1. Make a drawing of the bark of the Toothache tree in the box below. Carefully observe the tree's bark and accurately illustrate. Use map pencils to color the drawing.

TOOTHACHE TREE BARK

2. What is so unusual about the bark of the toothache tree?

3. Explain how the Indians and early settlers used the Toothache Tree.

TRAIL MARKER SIX

1. Make a drawing of the leaf of the Sassafras tree in the box below. Carefully observe the shape of the leaf and accurately illustrate. Use map pencils to color the drawing.

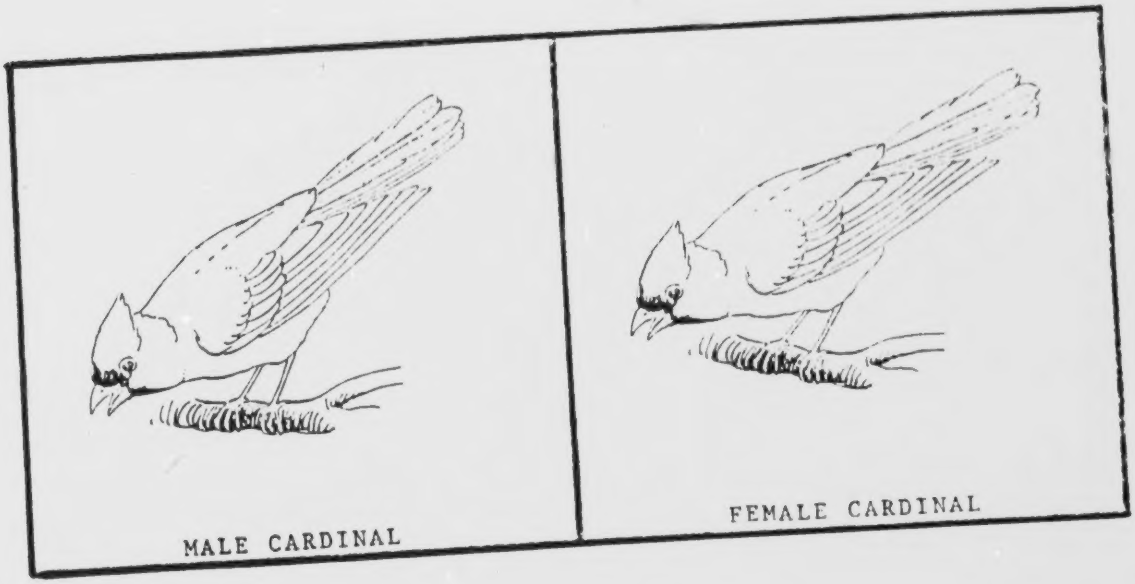
SASSAFRAS LEAF

2. Name two uses of the Sassafras tree.

   a.

   b.

3. One of the birds commonly seen in this area is the cardinal. The male cardinal is a bright red with a black beard around its beak. The female cardinal also has the black beard around its beak but breast and back are a light brown. Its wings, tail feathers, and crest are red. Using the above description color the illustrations below of the male and female cardinal.



MALE CARDINAL

FEMALE CARDINAL

4. Why does the female cardinal differ in coloration from the male cardinal?

5. Why are so many birds found in this area?

6. What kind of food might the cardinal and other birds feed upon in this area?

TRAIL MARKER SEVEN

1. Two major leaf types are represented by the mockernut hickory, post oak, and sweet gum trees here. The leaves of the post oak and sweet gum trees represent simple leaves. The leaves of the mockernut hickory tree represent compound leaves. A simple leaf consists of a single leaf blade with a stalk which attaches the leaf to the woody twig. The compound leaf consists of several leaflets joined to the stalk which in turn attaches the leaf to the woody twig. Make a drawing of the compound leaf found here in the box below. Make a drawing of one of the simple leaves found here in the box below. Carefully observe the leaf edges and veins and accurately illustrate. Use map pencils to color the drawings.

SIMPLE LEAF	COMPOUND LEAF

2. Write the name of the fruit produced by each of the trees listed below.

a. ______________________ mockernut hickory

b. ______________________ post oak

c. ______________________ sweet gum

TRAIL MARKER EIGHT

1. What is happening to the dead tree?

2. What evidence of decay or decomposition do you see in the dead tree?

   a.

   b.

   c.

3. List three decomposers at work breaking down this dead tree.

   a.

   b.

   c.

4. Name two organisms, other than decomposers, that may have made holes in the dead tree.

   a

   b.

TRAIL MARKER TEN

1. List two insect pollinators of the honeysuckle and blackberries.

   a.

   b.

2. Circle the description below that best describes the amount of sunlight this area receives.

   a. the area receives indirect sunlight because overhead trees block much of the incoming light

   b. the area receives direct sunlight because lack of overhead trees permits light to reach the ground

3. Circle the description below that best describes the dominant type of plants found here.

   a. large, woody trees

   b. small woody plants such as shrubs, bushes, and briars

   c. small herbaceous plants such as grasses, sedges, weeds, and herbs

4. Make a drawing of the flower of the honeysuckle in the box below. Carefully observe the shape and different parts of the flower and accurately illustrate. Use map pencils to color the drawing.

HONEYSUCKLE FLOWER

5. Make a drawing of the leaf, cane (stem), and fruit (berry) of the blackberry plant in the boxes that follow. Carefully observe the leaf edges and veins of the leaf, the shape of the cane, and the form of the berry. Accurately illustrate each drawing. Use map pencils to color the drawings.

BLACKBERRY LEAF

BLACKBERRY CANE

BLACKBERRY FRUIT

TRAIL MARKER THIRTEEN

1. Explain how the Possum-Haw Holly got its name.

2. Check the description below that best describes the tree trunk of the Possum-Haw Holly.

_____ a base with several branches

_____ a base with a single trunk

3. Check the description that best describes the area found here.

_____ woodland opening

_____ heavily forested with large trees

_____ thicket

4. Make a drawing of the Strangler Vine (Alabama Supplejack) which has wrapped itself around a Little-Hip Hawthorn in the box below. Carefully observe the girdling action of the vine and accurately illustrate. Use map pencils to color the drawing.

STRANGLER VINE

5. Make a drawing of the soft, corky wings of the Winged Elm in the box below. Carefully observe on of the "winged branches" and accurately illustrate. Use map pencils to color the drawing.

WINGED ELM

6. Check the leaf margin represented by the leaf of the Winged Elm below.

_____lobed

______serrate

_____smooth

TRAIL MARKER FOURTEEN

1. Name three vines found growing in this area.

a.

b.

c.

2. Check the description below that best describes the amount of sunlight this area receives.

____abundant sunlight

____moderate sunlight

____low sunlight

3. Why is there very little undergrowth (grasses, small plants, and bushes) in this area?

4. Check the leaf margin represented by the leaf of the Post Oak Tree below.

____lobed ____serrate ____smooth

TRAIL MARKER FIFTEEN

1. What is the name of the major thicket forming shrub growing here.

2. Make a drawing of the needleleaf of the loblolly pine in the box that follows. Carefully observe the number of needles in each cluster and accurately illustrate. Use map pencils to color the drawing.

LOBLOLLY PINE

3. What is the name of the fruit of the loblolly pine?

4. What insect is a harmful pest of the loblolly pine?

5. Observe the cross section of the tree trunk provided and match each description with the number identification tag.

    ______ heartwood (gives strength to tree, not actively growing)

    ______ outer bark (outer layer of a tree which protects it from harmful insects and diseases)

    ______ sapwood (actively growing, carries water from roots to leaves)

TRAIL MARKER SIXTEEN

1. This area was once severely disturbed by men using heavy equipment. The area is just beginning to grow back and over time will become forested again. Sequence (order) the stages from one to five that the area will pass through as it becomes a forest again.

   ______ Bare Soil Stage

   ______ Bush and Shrub Stage

   ______ Mature Hardwood Stage

   ______ Small Tree and Pine Stage

   ______ Weed, Grass and Herb Stage

2. What is the change in a community over time called?

AQUATIC STUDY PROJECT: DETECTING WATER POLLUTION
(adapted from Texas Water Commission W-E-T Instruction Handbook)

OBJECTIVES:

1. Aquatic Study Teams are formed.
2. Study Teams prepare for site visit by becoming familiar with field techniques, sampling equipment, and recording sheets.
3. Study Teams visit aquatic site and collect information on general characteristics of the study site.
4. Study Teams visit aquatic site and test for dissolved oxygen, pH, coliform, and phosphates.
5. Study teams share and analyze data collected and assess and report on the water quality of the aquatic site.
6. Study Teams prepare action plans to address water quality problems discovered.

MATERIALS:

Field Data Sheets
Plant and Animal Keys and Field Guides
Collecting Equipment
Camera and Film
Thermometers
Stop Watches
Cork Slices
Metric Measuring Tape
Hand Lenses/Stereomicroscopes/Microscopes
Scissors
Goggles
Gloves
Phosphate Test Kit and directions
Dissolved Oxygen Test Kit and directions
pH Test Kit and directions
Coliform Test Kit and directions

DAY ONE

PROCEDURES: OVERVIEW OF AQUATIC STUDY PROJECT

1. Assign or use some means of selecting students for aquatic study teams.
2. Handout copies of field data sheets, plant and animal keys, field quides, and water quality test information.
3. Direct study teams, with teacher guidance, to review field data sheets for site visits noting what observations are to be made, what information is to be recorded, and how the site map is to be prepared.
4. Construct and/or review use of any collection equipment.
5. Provide study teams time to discuss tasks, each person's role on the team, etc.
6. Review all safety rules and proper dress for upcoming visits to aquatic site.

DAY TWO

PROCEDURES: VISUAL SURVEY AND MAPPING OF AQUATIC STUDY SITE

1. Review safety rules with students.
2. Review tasks and recording methods.
3. Conduct Visual Survey of Site
   a. land use within water shed
   b. water use within watershed
   c. note alterations to aquatic study site
   d. note structures or barriers in aquatic study site
   e. note amount and type of litter present
4. Draw a scale map of the aquatic study site. Make a key to represent physical and biological features observed. Indicate scale and "NORTH" on map.
5. Describe, in writing, observations about aquatic study site and adjacent land.

DAY THREE

PROCEDURES: FIELD SURVEY AND DATA COLLECTION

1. Review safety rules with students.
2. Review tasks and recording methods.
3. Conduct Field Survey
   a. General Site Information
   b. Weather Conditions
   c. Water Appearance
   d. Cover
   e. Vegetation
   f. Collect, count, and identify biological samples

DAY FOUR

PROCEDURES: WATER QUALITY TESTING

1. Review safety rules with students.
2. Review tasks and recording methods.
3. Instruct students to wear safety goggles and gloves when handling chemicals
4. Go over the directions supplied with each test kit.
5. Conduct Field Tests
   a. Air Temperature
   b. Water Temperature
   c. Dissolved Oxygen
   d. pH
   e. Phosphate
   f. Coliform

DAY FIVE

PROCEDURES: DATA ANALYSIS

1. Study Teams report results of field tests, observations of aquatic life, and any water quality problems identified.
2. Study Teams attempt to identify causes of water quality problems or hypothesize about causes if no direct evidence exists.
3. Study Teams work on strategies to solve obvious water quality prolems i.e. litter/trash.

FIELD DATA SHEETS

Date: ______________________

Description of Aquatic Site: ______________________

Location: ______________________

Aquatic Study Team Members: ______________________

____

VISUAL SURVEY CHECKLIST

Land Use in the Watershed (circle those that apply)

Agriculture: Range Crops Logging
Industrial: Factories Utilities Waste Treatment
Residential: Homes Schools Stores
Recreation: Parks Athletic Complexes
Other:

Water Use in the Watershed (circle those that apply)

Drinking Water Supply
Industrial Water Supply
Agricultural Water Supply
Recreational Water Supply
Waste Disposal
Other:

Alterations to Aquatic Study Site

Yes/No
If Yes, Explain:

Structures or Barriers in the Aquatic Site (circle those that apply)

Dams

Bridges

Boardwalk

Rocks

Pipe

Other:

Litter (circle average number of small and large items)

Paper, Small Trash:	0 - 5	5 - 10	10 - 50	50+
Cans and Bottles:	0 - 5	5 - 10	10 - 50	50+
Tires, Carts, etc.:	0 - 5	5 - 10	10 - 50	50+

FIELD SURVEY CHECKLIST

General Site Information (describe):

Weather Conditions (describe)

Sky Coverage:

Cloud Type:

Wind Direction/Speed:

Precipitation:

Water Appearance (circle those that apply)

Scum

Foam

Muddy

Milky

Clear

Oily Sheen

Brownish

Other

Cover (circle those that apply)

Full Sun (75% - 100%)

Partial Sun (50% - 75%)

Partial Shade (25% - 50%)

Full Shade (75% - 100%)

Vegetation (indicate percent of coverage)

Trees (%)

Shrubs (%)

Herbaceous (%)

Emergent (%)

Submerged (%)

BIOLOGICAL SURVEY CHECKLIST

Algae

Present/Not Present

Arthropods

Insects (Numbers/Kinds)

Crustaceans (Numbers/Kinds)

Fish (Numbers/Kinds)

Amphibians (Numbers/Kinds)

Reptiles (Numbers/Kinds)

Birds (numbers/Kinds)

Mammals (Numbers/Kinds)

APPENDIX
ENVIRONMENTAL EDUCATION RESOURCES
PUBLICATIONS AND ADDRESSES

1. "W-E-T INSTRUCTION HANDBOOK"
   Published by Texas Water Commission-merged with TNRCC 9/1/93
   Texas Natural Resource Conservation Commission
   Park 35 Circle
   P.O. Box 13087
   Austin, Texas 78711-3087
   (512) 463-8305 (Environmental Education)
   (512) 463-7834 (Library)

2. "A GUIDE TO FRESHWATER ECOLOGY"
   Texas Natural Resource Conservation Commission
   Park 35 Circle
   P.O. Box 13087
   Austin, Texas 78711-3087
   (512) 463-7834 (Library)

3. "GROUNDWATER: A VITAL RESOURCE"
   TVA Office of Natural Resources
   Knoxville, TN 37902

4. "THE OUTDOOR CLASSROOM"
   Indiana Department of Education
   Room 229 State House
   Indianapolis IN 46204-2798
   (317) 232-9141
   Publication Fee: $3.00

5. "TAKE STUDENTS TO THE WILDS..."
   National Wildflower Research Center
   2600 FM 973 North
   Austin, TX 78725-4201
   (512) 929-3600
   Publication Fee: $6.00

6. "HERE TODAY HERE TOMORROW....."
   New Jersey Department of Environmental Protection
   401 East State Street
   Trenton, NJ 08625
7. "EARTH DAY EVERY DAY"
   United States Environmental Protection Agency
   401 M Street, S.W.
   Washington, D.C. 20460

8. "TEACHING SOIL AND WATER CONSERVATION"
   United States Department of Agriculture
   Soil Conservation Service
   Houston Field Office
   16151 Cairnway
   Houston, Texas 77084
   (713) 855-8716

9. "CONSERVING SOIL'
National Association of Conservation Districts
P.O. Box 855
League City, Texas 77574-0855
(713)
Publication Fee: $6.50 plus shipping

10. "WHATaWASTE"
Waste Education Clearinghouse
1350 Energy Lane
St. Paul MN 55108
Jeff Lederman
1-800-657-3843

11. "PROJECT WILD"
"AQUATIC WILD"
Texas Parks and Wildlife Department
4200 Smith School Road
Austin, Texas 78744
Kathyrn L. Hampton, Director
(512) 328-6085
*must attend training workshop to receive materials

12. "PROJECT LEARNING TREE"
Temple-Inland Forest Products Corporation
P.O. Drawer N
Diboll, TX 75941
Carolyn C. Elmore, Director
1-800-262-5512
*must attend training workshop to receive materials

W·E·T
INSTRUCTION
HANDBOOK

A Joint Project of the
Austin AIM High Office and the
Texas Water Commission

Background information written by Marie Nelson, Cindy Ellison and the staff of the Texas Water Commission

Teaching lessons written by Marilyn F. Cain and Jane K. Newchurch of the AIM High Office, Office of Gifted Education, Austin Independent School District

W·E·T
WATER EDUCATION TEAM

◆

September, 1990
LP 90-08

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

A Guide to Freshwater Ecology

July 1993

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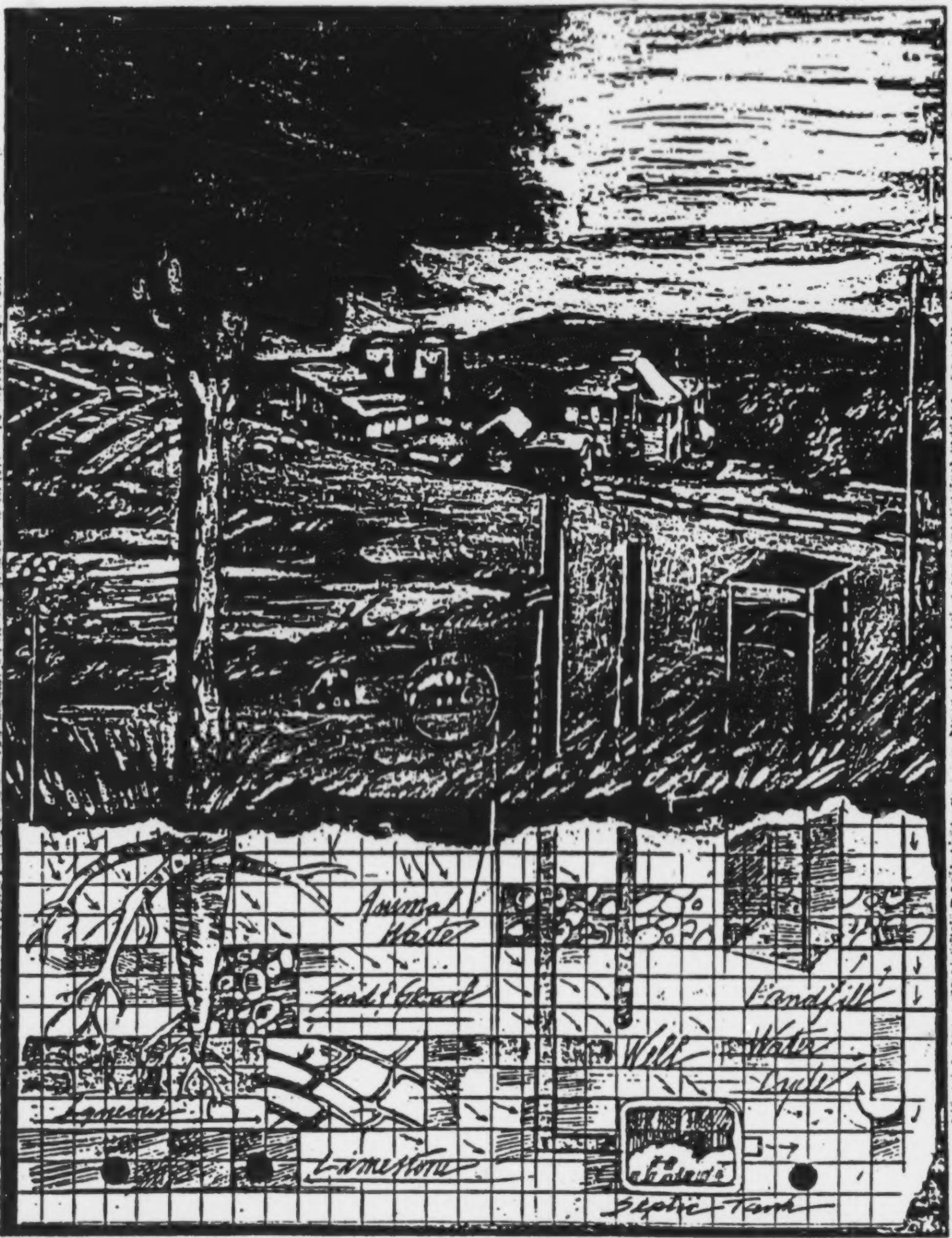
Animal Waste
Sand & Gravel
Landfill
Well
Water Table
Igneous
Limestone
Septic Tank

GROUNDWATER A VITAL RESOURCE

STUDENT ACTIVITIES

COMPILED BY CEDAR CREEK LEARNING CENTER IN COOPERATION WITH THE TENNESSEE VALLEY AUTHORITY

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4	"Calculating Water Table Depth"	Grades 9-12
5	"How Different Soils Affect the Movement of Water"	Grades 3-9
6	"Illustrating the Water Table"	Grades 4-8
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11	"Acid Rain—How Acid Is It?"	Grades 7-12
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19	"Groundwater Rights"	Grades 5-12
20	"How Does a Settling Tank Work?"	Grades 4-8
21	"Municipal Waste Contamination of Groundwater"	Grades 7-9
22	"Polluted Ponds Lead to Polluted Groundwater"	Grades 4-6
23	"Pollution of Groundwater"	Grades 9-12

The Outdoor Classroom

Experiencing Nature in the Elementary Curriculum

Indiana Department of Education

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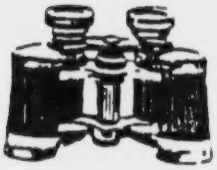
THE OUTDOOR CLASSROOM

Experiencing Nature
In the Elementary Curriculum



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Take Students to the Wilds... to Discover Wildflowers and Native Plants

A publication of the National Wildflower Research Center

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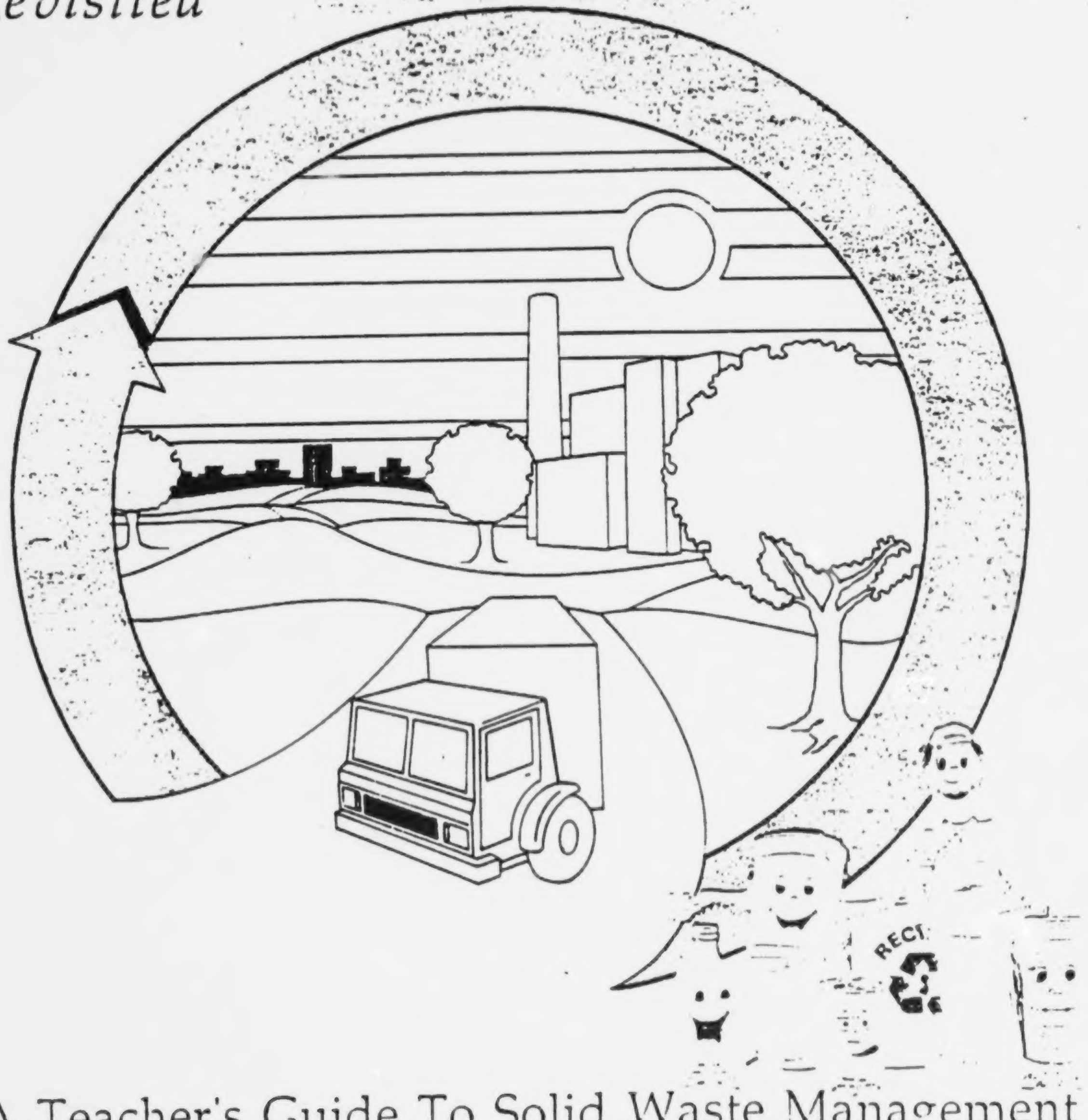
Here Today
Here Tomorrow.....

Revisited



A Teacher's Guide To Solid Waste Management

Activity Grid

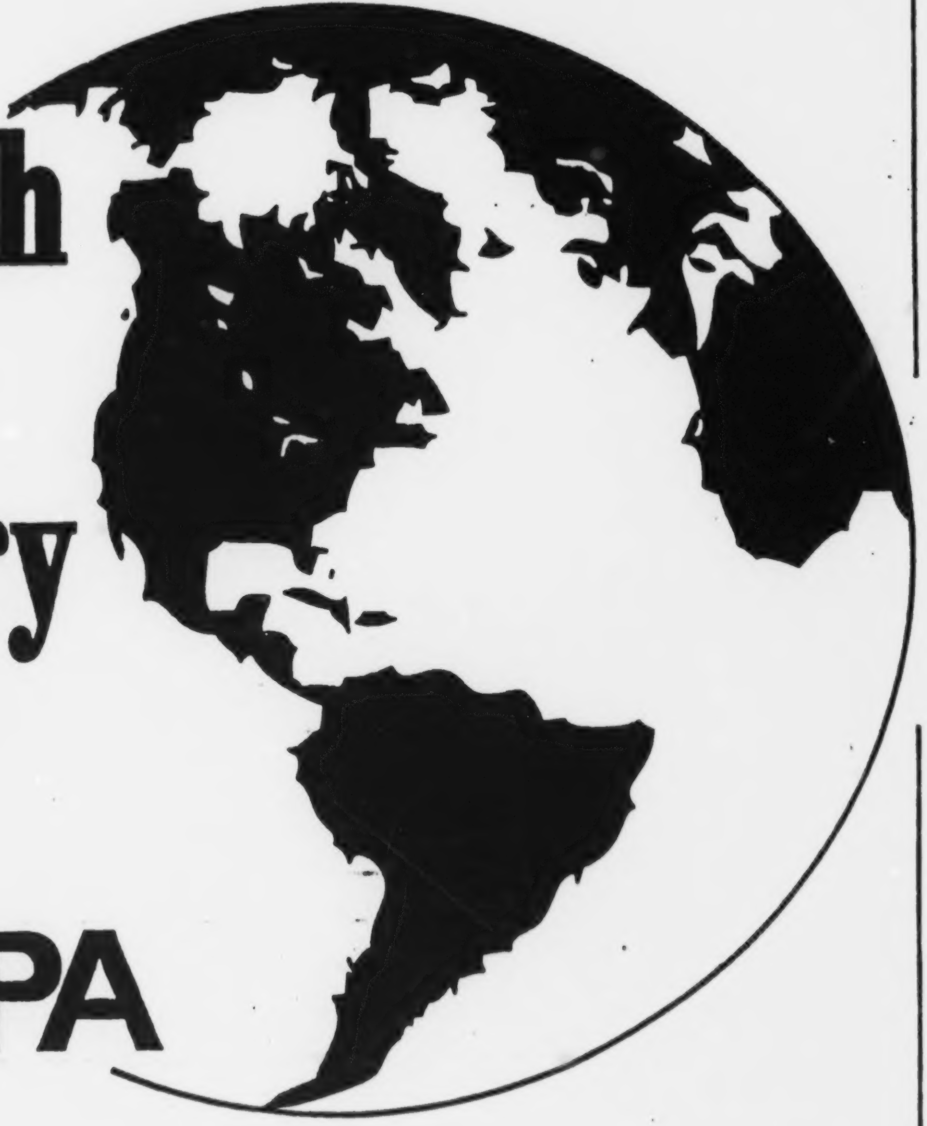
	General Awareness	Source Reduction	Recycling	Resource Recovery	Landfilling	Anti-Litter
A Topic You Can Dig Into	X				X	
Candid Camera	X					X
Can You I.D. Your Can			X			
Collage-Junk To Art	X					
Compost-A New Beginning	X		X			
Curbside Detective	X				X	
Don't Judge a Product By Its Wrappings	X	X				
Dressed For the Occasion	X	X				
Fast Food-Friends Forever		X				X
Finding The Way	X		X	X	X	
Garbage Through The Ages	X					
It's My Bag	X	X			X	
Leaky Landfills					X	
Litter Lookout						X
Look What Was In Your Garbage Can	X		X			
Packaging ! Why ?	X	X	X			
Plastic Connection	X		X			
Rap Around The Block	X					X
Rap On Wrap		X			X	
Resource Recovery, Where To Locate ?				X		
Solid Waste Survey	X					
Take Home "How To Recycle Kit"			X			
Trash To Ash				X		
Waste In Time	X					
Week's Worth	X		X			
What Do I Do With This	X					X
What Is Your Landfill I.Q.					X	
When It's Wrong To Belong Scavenger Hunt	X					
When Will It Ever End ?					X	
Why Buy Me ?					X	

Office of Water
WH-556

EPA 800-B-93-004
March 1993

Teacher's Kit

Earth Day Every Day



EPA

United States Environmental Protection Agency

Earth Day Teacher Kit

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United States
Department of
Agriculture

**Soil
Conservation
Service**

Program Aid
Number 341

Teaching Soil and Water Conservation

A Classroom and Field Guide

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Washington, D. C.

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Conserving Soil

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TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME: Ann Miller

INTERNSHIP: Texas Parks & Wildlife

SCHOOL: Lake Travis Middle School
Austin, Texas

PRIMARY SUBJECT: Earth Science/Environmental Science

ACTIVITIES:

- Counting the Kill
- Bug Picking in the Classroom
- Aquatic Wild - "Are You Me?" and "Fashion a Fish"

SUMMARY: The activities listed above are intended to: acquaint students with aquatic life in our rivers, lakes, and streams; help them discover ways in which water resources can be polluted; determine ways in which thay can help solve pollution problems. Becuase the 5 regional biologists of the Kills and Spills Team have the entire state of Texas to cover as they investigate wildlife kills and chemical spills, students are encouraged to be part of the team by calling the biologist in their region if they witness a wildlife kill or chemical spill.

RESOURCES: Project WILD and Aquatic Wild
Texas Parks & Wildlife

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INTERNSHIP: Texas Parks and Wildlife

MENTOR: Dave Buzan

SCHOOL: Lake Travis Middle School

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RESOURCES: Project Wild and Aquatic Wild

Background

Thousands of bloated dead fish float down a creek flowing through a central Texas town. Investigation reveals a sewage line leaking raw wastewater into the creek and killing the fish. Tarpon and redfish try to jump out of the water in their death throes. Poisonous chemicals are traced to an industrial discharge which experienced an accidental release. Fish along a hundred miles of river die following the population explosion of a microscopic plant toxic to fish.

A thirty-year old crude oil pipeline ruptures spilling 300 barrels of oil in a ecologically-sensitive coastal marsh. Thousands of gallons of toxic acid leak into a river from a ruptured railroad tank car during a train wreck. A spill is reported threatening the habitat of an endangered species of toad.

When fish and wildlife are killed or threatened by spills or leaks of hazardous chemicals, Texans hope the Texas Parks and Wildlife Department will respond in a way which minimizes additional damage to the environment. The Department's Kills and Spills Team responds to these emergency incidents threatening fish and wildlife all over the state.

A Kills and Spills Team biologist is located in San Marcos, Waco, Tyler, Seabrook and Corpus Christi. When a kill or spill occurs, each biologist is trained to respond quickly and safely to pollution incidents, identify environmental threats, coordinate the elimination of the threat and estimate the amount of environmental damage resulting from the incident. When an individual or organization is identified as responsible for the incident, the Kills and Spills biologist begins a process seeking repayment to the state for the value of fish and wildlife harmed. The repayment is based on the numbers, types and sizes of animals and plants killed or injured as well as the state costs associated with investigating the incident.

The typical Kills and Spills biologist has a college degree in environmental science with considerable work experience in fish biology and water quality. The Kills and Spills biologist for each region of the state must be knowledgable about different ecosystems including piney woods with acidic stream waters, limestone-dominated watersheds in central Texas, desert springs in west Texas, and coastal marshes. Each biologist responds to a wide variety of pollution complaints in addition to kills and spills response. The team has an intensive public awareness program which helps the public understand the threats to the environment resulting from those incidents.

Because of their expertise in water quality issues, the biologists evaluate the impacts of activities which discharge treated wastewaters in the state. This work involves working closely with other local, state and federal agencies which are responsible regulating those wastewater discharges.

Limits on wastewater may be proposed by biologists. Aquatic surveys may be conductd to determine the impacts of wastewater discharges on the aquatic community. Biologists may be expert witnesses in public hearings to ~~determine~~ the status of wastewater discharges

Call the Kills and Spills Team if you observe a fish or wildlife kill or if you observe any pollution threatening fish and wildlife. In addition, if you have any questions about water quality and its relationship to fish and wildlife please feel free to contact the Kills and Spills Team for assistance.

"COUNTING THE KILL"

DEVELOPED BY ANN MILLER - TEACHER INTERN, TEXAS PARKS AND WILDLIFE
MENTOR - DAVE BUZAN - KILLS AND SPILLS TEAM LEADER

I. Objectives - Students will:

1. solve the problem of how to quickly estimate the number of "fish" that resulted from a fictitious fish kill in a box
2. explain why biologists must count the dead fish quickly
3. discuss the difference between an estimate and an exact count
4. define the word bias and explain why a person's bias could affect the count of a fish kill
5. explain why the count must not be biased
6. brainstorm to come up with ideas about what could cause fish kills
7. view slides to discover what wildlife biologists do when a fish kill has been reported
8. decide what personal actions to take if they sight a fish kill or toxic spill
9. decide what lifestyle changes we can make to help reduce water pollution that can affect aquatic wildlife

II. Materials needed for each cooperative learning group

1. Box with a grid that divides the box into 6 sections
2. 200 "fish" (This could be colored beads, fish crackers, small colored marshmallows, or cereals like "Cheerios"). Use two or more different colors or shapes.
3. Watch or clock with a second hand
4. Set of slides or pictures that illustrate to the students what causes fish kills
5. one die for each lab group

6. student activity sheet

III. Key Vocabulary

estimate, representative sample, bias, toxic alga pesticide, oil spill

IV. Background

(See attachment)

V. Procedure

1. Review background material and introduce students to the job of the Kills and Spills team.

2. Pass out prepared boxes to each lab group and explain that one of the hardest jobs of the Kills and Spills team is to get an accurate estimate of the numbers of dead fish in a fish kill. If the cause of the kill can be traced back to an individual or specific company, then that company or individual will be held responsible and made to pay damages. If the fish are threatened or endangered, the cost could be thousands of dollars per fish.

3. Tell students that their job is to count the number of "fish" killed in their box in 30 seconds. Biologists often have to count very quickly before the fish get carried downstream or they are eaten by predators or scavengers. Have students shake the box gently and then open it when you say go. You will say stop after 30 seconds.

4. After 30 seconds are up, illicit responses from each group and find out if they had trouble doing the count. (You should have students say that they didn't have enough time to count all of the fish.)

5. Ask students how biologists in the field might solve this problem. Lead the students to come up with the idea of estimating by counting the fish in one square, then multiplying by the number of squares. This is called taking a representative or scientific sample.

6. Ask students to imagine they are biologists and that they are angry about the fish kill. If they could count only 1 square, what square would they count and why? What if they were too busy and didn't have a lot of time? What square would they count? Is that fair to the people who must pay for the dead fish or to the Parks and Wildlife that spends money stocking them?

Introduce students to the idea of bias and explain that biologists must conduct their fish counts in such a way that it is not a biased estimate of the number of dead fish. In the classroom, we will eliminate bias by using dice to decide which square to count.

7. Ask students to close their boxes and shake gently up and down. Then they will roll the dice to see which square to count. When you say go they will have 15 seconds to count the fish in one square and come up with an estimate of the number of fish in the box.

8. Ask the students for their fish counts and write them on the board. At this time you might have to consider what you would do if you selected a sampling area that had either none of the fish or almost all of the fish. Students can easily see that you might either have to roll again or take a high and low square and average them before multiplying.

9. Ask students if they have any ideas about what could cause a fish kill. Show slides that illustrate the causes of some fish kills. Talk about oil and chemical spills. Tell them that even though plants add oxygen to the water in the daytime, they actually take oxygen out of the water at night. If there are too many plants in the water, they can take so much oxygen out of the water that fish will not get enough and will die. Water plants, called algae can grow fast when there is fertilizer in the water. Fertilizer can be added when rain washes it into a stream from a person's yard or farmer's field. It can also come from sewage or treated effluent which is often piped into rivers.

VI. CONCLUSION

1. Ask students what they could do if they found a toxic spill or fish kill. Emphasize to students that the Kills and Spills team often gets information from citizens. Pass out the maps showing the names, phone numbers, and regions for each of the pollution biologists. Ask them to be a part of the team and report to the biologist in their region if they see a kill or spill that is significant. You might have to talk about what would be a significant incident that should be reported.

2. Ask students what personal actions they could take to help stop water pollution.

VII. EXTENSION

To illustrate that there is usually more than 1 kind of fish killed and that they need to be counted separately to get an accurate cost estimate, have the students count the fish in the different categories and see what differences they will find. Would this affect the fairness of the count?

What might you learn about the cause of the kill by investigating the different species and sizes of fish killed? (The kill could be caused by a fish disease if only one type and size of fish are dead, especially if other types and sizes appear to be healthy.)

COUNTING THE KILL - STUDENT ACTIVITY SHEET

1. What number did you roll(draw) for the count? ________________

2. How many squares do you have in all? ____________

3. Use the space below to arrive at an estimate of the total fish kill in your box.

4. How does your total compare with the totals in the rest of the class?

5. If you were going to be held responsible for paying for the dead fish, which total would you want? ___________ Which one would you be unhappy with? __________

6. If the dead fish were given a value of _____________ what would you have to pay?

7. What are some other causes of fish kills?

8. What can you do to help minimize problems that cause fish kills?

9. Who would you contact in your area to report a situation in which you saw a number of dead or distressed wildlife?

EXTENSION

Close the box, shake gently up and down, and roll the die to see which square to count. This time, you will count and record the number of each type of fish in the square and make your estimate of the total by multiplying each by 6. Then to get an idea of what the value of the total kill would be, multiply as shown.

fish # 1 _________ X $2.00 per fish = $__________

fish # 2 _________ X $50.00 per fish = $__________

fish # 3 _________ X $1000.00 per fish = $__________

Total $__________

How does this value for the fish differ from your answer in #6?

TEXAS PARKS AND WILDLIFE DEPARTMENT

Kills and Spills Team

If you see dead or dying fish and wildlife or pollution threatening fish and wildlife, call one of the regional biologists or 24-hour Communication Centers listed below immediately!

Austin Headquarters

24-hr Communication Center
(512) 389-4848
Jack Ralph or Dave Buzan
Office: (512) 389-4726
Mobile: (512) 217-3728
FAX: (512) 389-4394
Beeper: Dave Buzan (512) 505-9807
Jack Ralph (512) 505-9800
TPWD Radio #: Dave Buzan 813
Jack Ralph 812

4200 Smith School Road
Austin, Texas 78744

Region 2

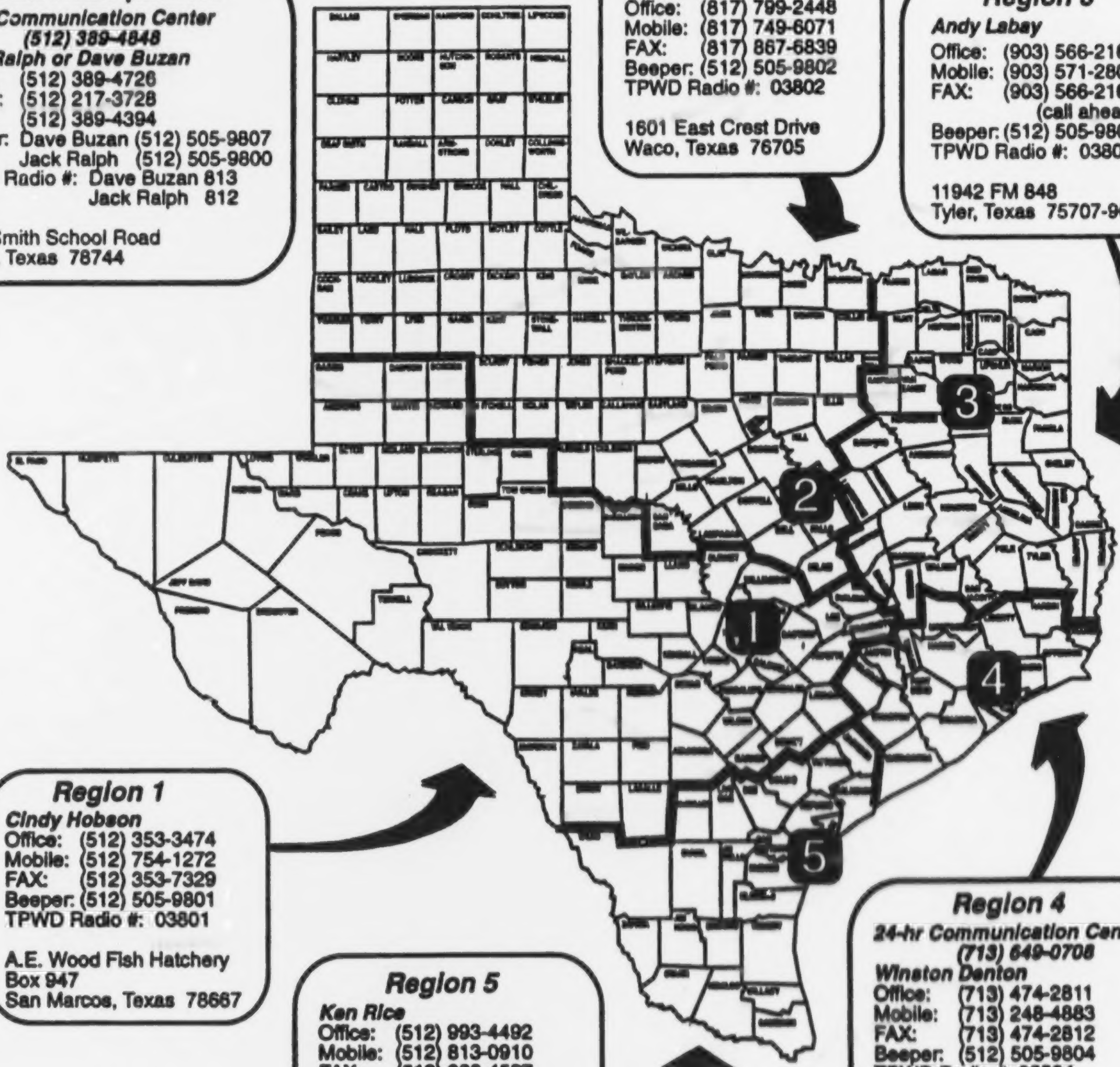
Joan Glass
Office: (817) 799-2448
Mobile: (817) 749-6071
FAX: (817) 867-6839
Beeper: (512) 505-9802
TPWD Radio #: 03802

1601 East Crest Drive
Waco, Texas 76705

Region 3

Andy Labay
Office: (903) 566-2162
Mobile: (903) 571-2807
FAX: (903) 566-2162
(call ahead)
Beeper: (512) 505-9803
TPWD Radio #: 03803

11942 FM 848
Tyler, Texas 75707-9657



Region 1

Cindy Hobson
Office: (512) 353-3474
Mobile: (512) 754-1272
FAX: (512) 353-7329
Beeper: (512) 505-9801
TPWD Radio #: 03801

A.E. Wood Fish Hatchery
Box 947
San Marcos, Texas 78667

Region 5

Ken Rice
Office: (512) 993-4492
Mobile: (512) 813-0910
FAX: (512) 993-4597
Beeper: (512) 505-9805
TPWD Radio #: 03805

Campus Box 317
CCSU, 6300 Ocean Drive
Corpus Christi, Texas 78412

Region 4

24-hr Communication Center
(713) 649-0708
Winston Denton
Office: (713) 474-2811
Mobile: (713) 248-4883
FAX: (713) 474-2812
Beeper: (512) 505-9804
TPWD Radio #: 03804

P.O. Box 8
1018 Todville Road
Seabrook, Texas 77586

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BUG PICKERS IN THE CLASSROOM

Intern: Ann Miller
Science Teacher
Lake Travis Middle School

Mentor: Dave Buzan
Kills and Spills Team Program Leader
Resource Protection Division
Texas Parks and Wildlife Department

OBJECTIVES:

1. Given a variety of fresh water macroinvertebrates, students will create a classification system for them and divide them into their groups.

2. Students will compare the "bugs" they have classified to the macroinvertebrates on the "Kills and Spills" handout and determine the name of each and the water quality it can tolerate.

3. Students will draw a conclusion about the water quality of the stream or river the "bugs" came from.

BACKGROUND

In the field, biologists can get a good idea of the "health" of a stream by inspecting the kinds and numbers of macroinvertebrates present. Some insects are much more tolerant of poor water quality than others. An abundance of those insects and an absence of insects that are pollution sensitive often indicates a pollution problem. This exercise is designed as a classroom activity to be used with organisms that have been previously gathered and brought to the classroom when a class field trip to a nearby stream is impossible.

MATERIALS FOR EACH GROUP

10-15 macroinvertebrates in a pan of creek water
5 or 6 small white disposable bowls
a pair of forceps for each person
an insect identification page
several hand lenses

PROCEDURE:

1. Pass out a tray of the macroinvertebrates to each group along with the bowls, forceps, and hand lenses.

2. Ask students to use the forceps and hand lenses to carefully and gently examine the "bugs." They will be looking for similarities and differences in order to divide them into groups. They will place the different groups into seperate bowls.

3. After students have completed dividing the organisms, ask them to discuss their criteria for seperating the organisms into the different groups. Take time to allow students to respond to the different criteria used by different student groups.

4. Pass out the Kills and Spills Team sheet with the insect identification information on the back. Call attention to the way the insects are grouped according to their pollution tolerance, with goup 1 taxa being found in good quality water, group 2 being found in good or fair quality water, and group 3 insects able to tolerate poor quality water. Ask students to identify their insects and determine the water quality of the stream by comparing their insects to the three groups. They may fill out the student activity sheet at this time.

5. Discuss the findings of the different groups.

EXTENSIONS

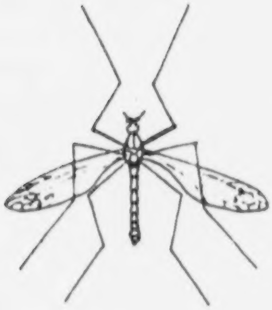
1. Allow students time to discuss the special adaptations that some of the organisms have to live successfully in the water. What do these organisms need to survive?

2. Ask students to identify what they think might pollute the water. What personal action can they take to help reduce pollution? What are some special pollution problems in their area? Students my want to begin a volunteer water monitoring program sponsored by the TNRCC, called Texas Watch. Call (512)463-8206 for information about this program.

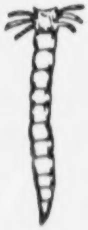
3. What important role do these organisms play in the aquatic food chain? How do some of them change during their life cycles? Ask students to draw diagrams of aquatic food chains using some of these organisms. They could also draw a scene showing the life cycle of one or more of the insects (egg, larva, adult) and the habitat they live in. Many live on the stream bottom or on rocks.

4. If it is impossible to get live "bugs", you may want to xerox copies of the organisms taken from the Aquatic Wild guide, "Are You Me?" Cut them apart and pass a set of them out to the groups to complete the activity.

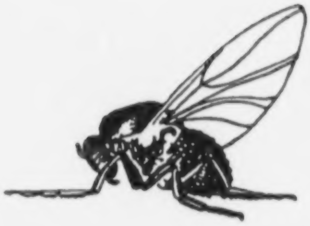
AQUATIC INVERTEBRATES



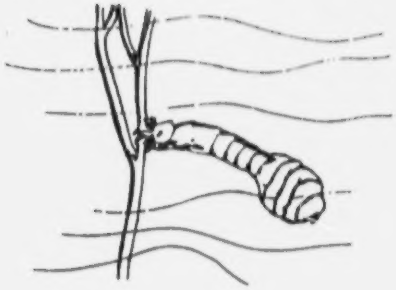
Cranefly



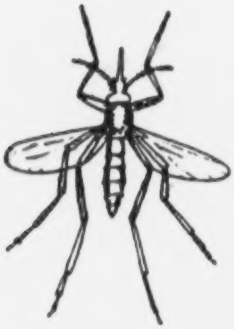
Cranefly Larva



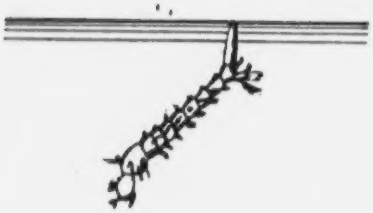
Black Fly



Black Fly Larva



Mosquito



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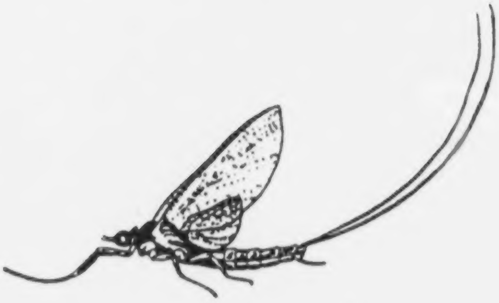

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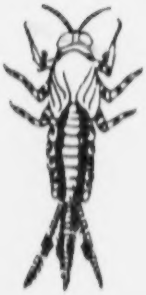
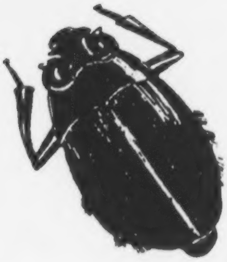


Mayfly Nymph

AQUATIC INVERTEBRATES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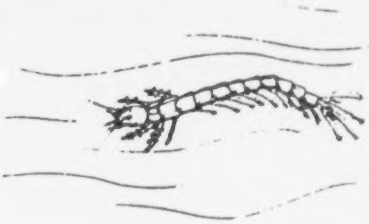
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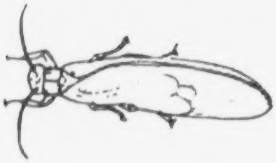
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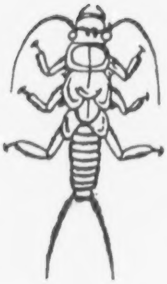
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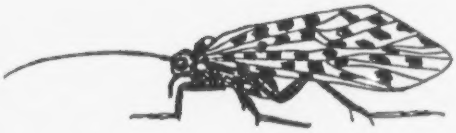
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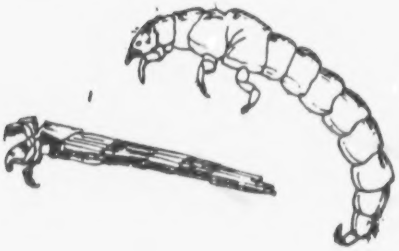
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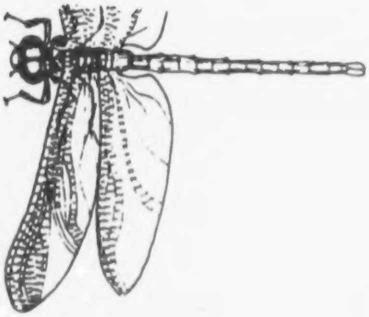
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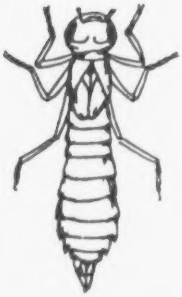
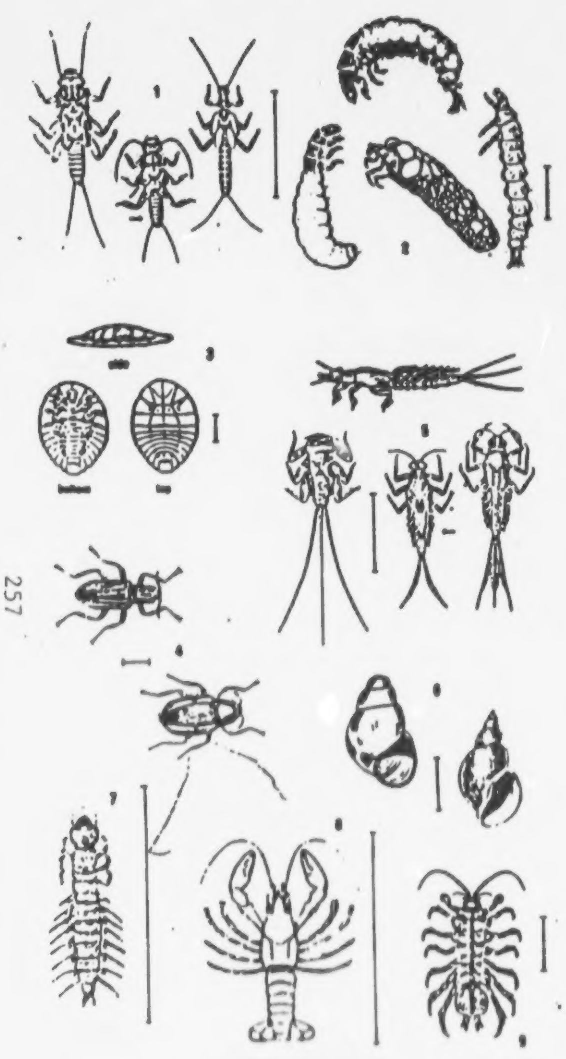

Dragonfly Nymph



Bar lines indicate relative size

Stream Insects & Crustaceans

GROUP ONE TAXA

Pollution sensitive organisms found in good quality water.

1 *Stonefly: Order Plecoptera.* 1/2" - 1 1/2", 6 legs with hooked tips, antennae, 2 hair-like tails. Smooth (no gills) on lower half of body. (See arrow.)

2 *Caddisfly: Order Trichoptera.* Up to 1", 6 hooked legs on upper third of body, 2 hooks at back end. May be in a stick, rock or leaf case with its head sticking out. May have fluffy gill tufts on lower half.

3 *Water Penny: Order Coleoptera.* 1/4", flat saucer-shaped body with a raised bump on one side and 6 tiny legs on the other side. Immature beetle.

4 *Riffle Beetle: Order Coleoptera.* 1/4", oval body covered with tiny hairs, 6 legs, antennae. Walks slowly underwater. Does not swim on surface.

5 *Mayfly: Order Ephemeroptera.* 1/4" - 1", brown, moving, plate-like or feathery gills on sides of lower body (see arrow), 6 large hooked legs, antennae, 2 or 3 long, hair-like tails. Tails may be webbed together.

6 *Gilled Snail: Class Gastropoda.* Shell opening covered by thin plate called operculum. Shell usually opens on right.

7 *Dobsonfly (Hellgrammite): Family Corydalidae.* 3/4" - 4", dark-colored, 6 legs, large pinching jaws, eight pairs feelers on lower half of body with paired cotton-like gill tufts along underside, short antennae, 2 tails and 2 pairs of hooks at back end.

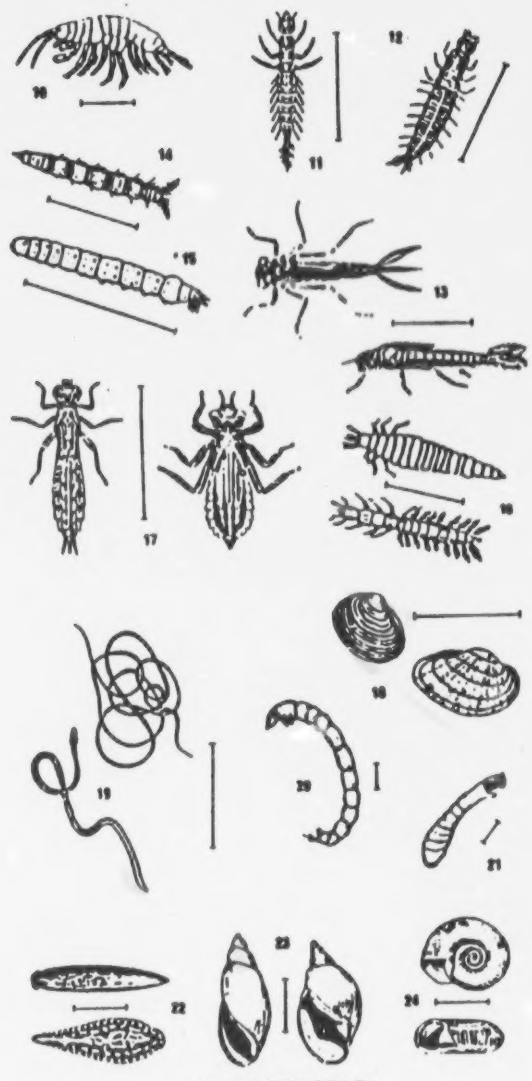
GROUP TWO TAXA

Somewhat pollution tolerant organisms can be in good or fair quality water.

8 *Crayfish: Order Decapoda.* Up to 6", 2 large claws, 8 legs, resembles small lobster.

9 *Sowbug: Order Isopoda.* 1/4" - 3/4", gray oblong body wider than it is high, more than 6 legs, long antennae.

Save Our Streams
Izaak Walton League of America
1401 Wilson Blvd., Level B
Arlington, VA 22209



Bar lines indicate relative size

GROUP TWO TAXA continued

10 *Scud: Order Amphipoda.* 1/4", white to gray, body higher than it is wide, swims sideways, more than 6 legs, resembles small shrimp.

11 *Alderfly larva: Family Sialidae.* 1" long. Looks like small hellgrammite but has 1 long, thin, branched tail at back end (no hooks). No gill tufts underneath.

12 *Fishfly larva: Family Corydalidae.* Up to 1 1/2" long. Looks like small hellgrammite but often a lighter reddish-tan color, or with yellowish streaks. No gill tufts underneath.

13 *Damselfly: Suborder Zygoptera.* 1/2" - 1", large eyes, 6 thin hooked legs, 3 broad oar-shaped tails, positioned like a tripod. Smooth (no gills) on sides of lower half of body. (See arrow.)

14 *Watersnipe Fly Larva: Family Athericidae (Atherix).* 1/4" - 1", pale to green, tapered body, many caterpillar-like legs, conical head, feathery "horns" at back end.

15 *Crane Fly: Suborder Nematocera.* 1/3" - 2", milky, green, or light brown, plump caterpillar-like segmented body, 4 finger-like lobes at back end.

16 *Beetle Larva: Order Coleoptera.* 1/4" - 1", light-colored, 6 legs on upper half of body, feelers, antennae.

17 *Dragon Fly: Suborder Anisoptera.* 1/2" - 2", large eyes, 6 hooked legs. Wide oval to round abdomen.

18 *Clam: Class Bivalvia.*

GROUP THREE TAXA

Pollution tolerant organisms can be in any quality of water.

19 *Aquatic Worm: Class Oligochaeta.* 1/4" - 2", can be very tiny; thin worm-like body.

20 *Midge Fly Larva: Suborder Nematocera.* Up to 1/4", dark head, worm-like segmented body, 2 tiny legs on each side.

21 *Blackfly Larva: Family Simulidae.* Up to 1/4", one end of body wider. Black head, suction pad on end.

22 *Leech: Order Hirudinea.* 1/4" - 2", brown, slimy body, ends with suction pads.

23 *Pouch Snail and Pond Snails: Class Gastropoda.* No operculum. Breathe air. Shell usually opens on left.

24 *Other snails: Class Gastropoda.* No operculum. Breathe air. Snail shell coils in one plane.

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IS THE CREEK CLEAN OR POLLUTED? – TEST YOUR BUG PICKING SKILLS!!!

Choose one container and using the Stream Insects picture sheet, identify ten animals in the container. Check the box for each different type of insect you identify. If you see the same type of insect several times you only need to check the box one time.

Sensitive to pollution

☐ Caddisfly
☐ Dobsonfly
☐ Mayfly
☐ Gilled Snail
☐ Riffle Beetle
☐ Stonefly
☐ Water Penny

Somewhat sensitive to pollution

☐ Beetle Larva
☐ Clam
☐ Crane Fly
☐ Crayfish
☐ Damselfly
☐ Dragon Fly
☐ Scud
☐ Sowbug
☐ Fishfly Larva
☐ Alderfly Larva
☐ Watersnipe Fly Larva

Tolerate pollution

☐ Aquatic Worm
☐ Blackfly
☐ Leech
☐ Midge Fly
☐ Pouch Snail

# of boxes checked x 3 = ____ # of boxes checked x 2 = ____ # of boxes checked x 1 = ____

Now add the values for the Sensitive, Somewhat Sensitive and Tolerant types of insects, total = ____

WATER QUALITY RATING: Check the box which applies to the total score you obtained.

☐ Excellent (total value more than 13)
☐ Good (total value between 9 and 13)
☐ Fair (total value between 6 and 9)
☐ Poor (total value less than 6)

Write the name of your creek container here:

____

ARE YOU ME?

OBJECTIVE

Students will be able to recognize various young stages of aquatic animals and match them with corresponding adult stages.

METHOD

Using picture cards, students match pairs of juvenile and adult aquatic animals.

BACKGROUND

Many animals look significantly different in their earliest stages of development when compared to adulthood. This is obviously true for some aquatic insects. Many aquatic insects undergo metamorphosis. Metamorphosis means change during growth. Some insects experience simple metamorphosis while others undergo complete metamorphosis. In simple metamorphosis, the insect egg hatches to produce a **nymph**. Nymphs may begin to resemble adults but they still may vary considerably from their adult form.

Insects that experience complete metamorphosis are characterized by eggs that hatch into **larvae**. The larva grows through several stages and then changes into a **pupa**. Pupae are usually encased in a protective cover for their next stage of growth. From the pupae emerge the soft-bodied, often pale-colored, adults. They differ remarkably in appearance from their earlier forms but are not yet completely formed. Gradually the soft pale body develops firmness and color. In complete metamorphosis, there is little resemblance between the adult and earlier forms.

There are also remarkable similarities and differences between other aquatic animals in different life stages. The eggs of many animals hide their eventual form (alligators, turtles, birds). Pelican hatchlings, for example, may be the closest image of miniature dinosaurs to be found on the planet. Aquatic mammals often are easy to recognize. They frequently do not change as dramatically as some other animals in overall appearance as they grow from young to adult stages.

The major purpose of this activity is for students to recognize that there are differences in the life stages of aquatic animals as they grow. The students will increase their appreciation of the diversity of wildlife as well as their understanding of growth and change in animals.

MATERIALS

cardboard for making picture cards; marking pens or crayons

PROCEDURE

1. Make pairs of aquatic animal cards. The animals in the pair should be the same kind. For example, one might be a pair of beavers; another might be a pair of pelicans. One animal in the pair should be an adult, the other should be at a younger stage of development. The pairs might include adult, larva, nymph, hatchling, juvenile, infant and/or egg forms of aquatic animals. You may use the masters provided.
2. Ask the children to bring two pictures from home. One should be of an adult, the other should be a picture of a child. The pictures should be pictures of the same person as an adult and as a child. For example, the pair may be of the student's parent as an adult and in a childhood picture, or it may be a school picture of the student and a picture of the student as an infant.
3. Divide the class into small groups of three or four students each. Have them hold their own set of paired pictures in their hands. Assign each group a single table or station. Ask them to stand in a circle around that station.
4. Have the students at each station place their pairs of pictures on the table and mix them randomly. Once the adult-child pictures are mixed at each table, have the entire group shift to another table so there will not be anyone at the tables where their own pictures are placed.
5. At the new table, have the group attempt to match pairs of adult/child or student and infant photos.
6. When the students at each table have completed their efforts to match the pairs, ask all of the groups to return to their original tables—the places they left their own pairs of pictures. Are the matches correct? Ask the students to change any pairs that are not correctly matched. Talk about how difficult or easy it was to correctly match pairs. Introduce the idea that many animals look remarkably different as adults than they appeared in younger forms. Tell the students that they are about to learn how to match young and adult forms of many different kinds of aquatic animals.

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7. Introduce the aquatic animal cards and divide the class in two. Designate one half of the students "adults" and the other half "young animals." Give each student in the "adult group" an "adult" animal image. Give each student in the "young animal" group a "young animal" image. Make sure there is a corresponding match, adult or juvenile, for each card given. Instruct the students to look for their "match"—pairing the appropriate adult and juvenile forms. NOTE: You can attach each animal card to a string loop so the pictures can be hung around the students' necks as they try to match the pictures.

8. When all the students have made their choices and think they have a match, let everyone help to see if the matches are correct. Some are more difficult than others and may be confusing. You may show the students the matched images on the master.

9. Have all of the students look at all of the correctly matched pairs. Look at similarities and differences in how different kinds of aquatic animals grow and change.

NOTE: This activity can be repeated several times by shuffling the adult and young images and passing them to new "animals" so that each student becomes familiar with a wider array of animals.

EXTENSIONS

1. Find out as much as possible about some of the habitats in which these animals live.
2. If possible, visit some of the habitats where the animals are actually found.
3. Pick a pair of images and find out more about the life cycles of the animals shown.
4. Discuss and/or pantomime the concept of metamorphosis.

EVALUATION

Pick two aquatic animals. Draw a picture of each animal as an adult and another picture of each animal as it looks when it is young.

Age: Grades K-2
Subjects: Science
Skills: analysis, classification, communication, comparing similarities and differences, matching, recognition, small group work
Duration: one or two 20-minute periods; preparation time for students to bring family pictures to class
Group Size: small groups of three or four students each; card masters are provided; duplicates may be used if needed, or fewer cards if the class is smaller
Setting: indoors
Conceptual Framework Reference: I.B., I.B.1., I.B.3., I.B.4., III.C.
Key Vocabulary: aquatic animals, grow, change, adult, young
Appendices: None

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Osprey Hatchlings

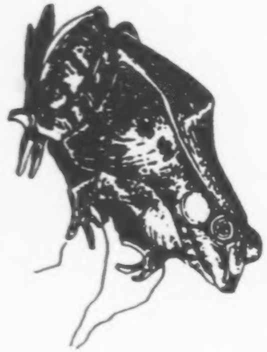
Stonefly Nymph

Dragonfly Nymph

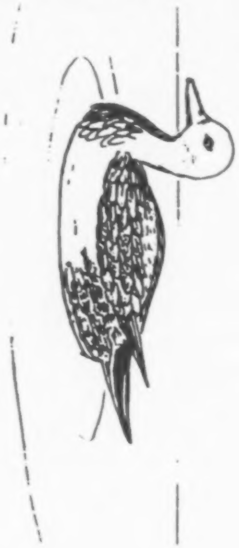
Caddisfly Larvae

Whirligig Larva

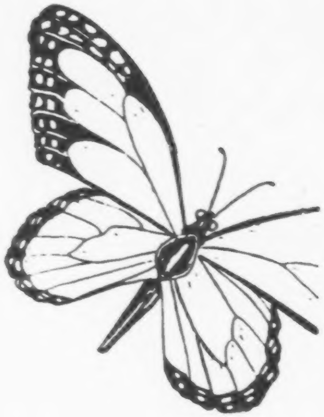
Frog



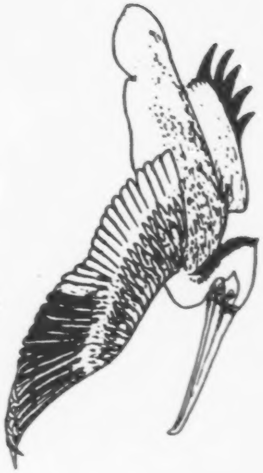
Duck



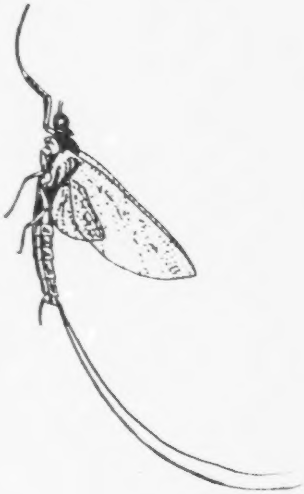
Butterfly

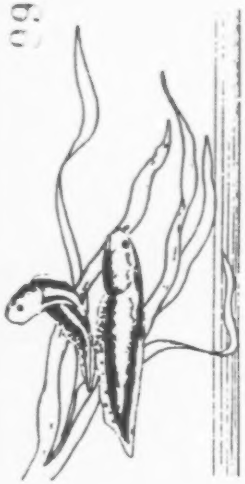


Pelican

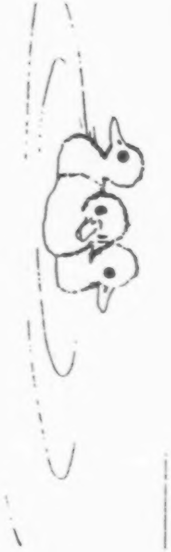


Mayfly

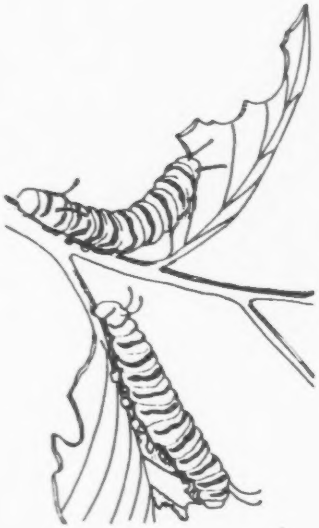




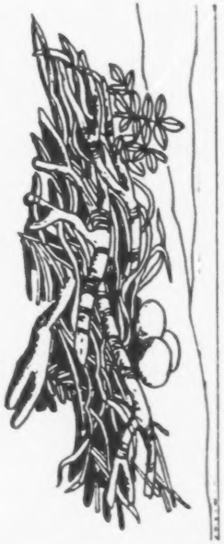
Tadpoles



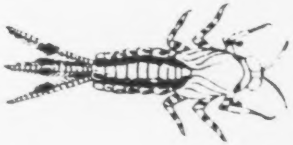
Ducklings



Butterfly Larvae

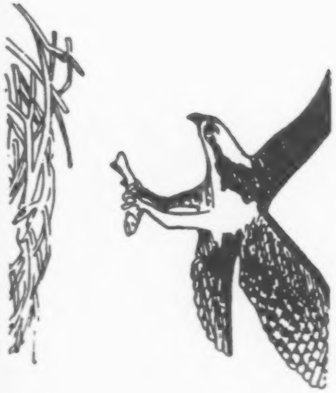


Pelican Nest and Eggs

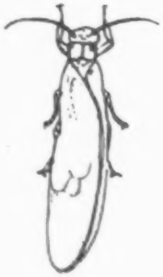


Mayfly Nymph

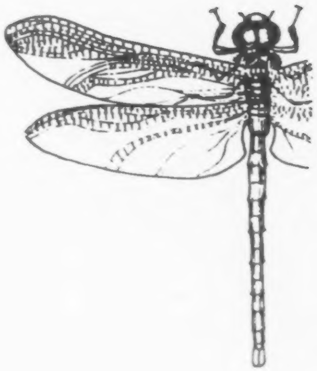
Osprey



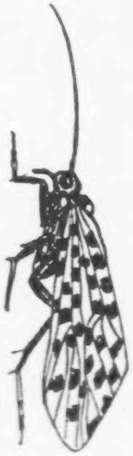
Stonefly



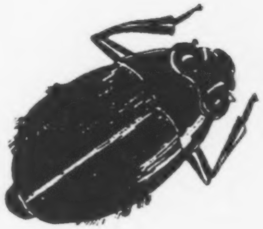
Dragonfly

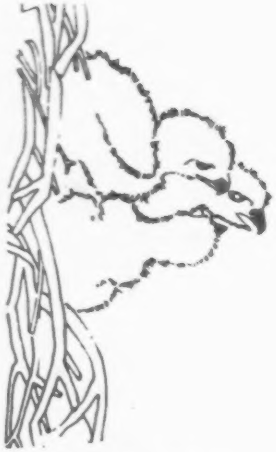


Caddisfly

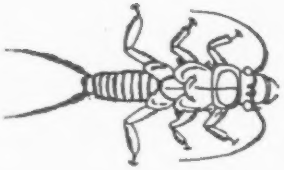


Whirligig Beetle

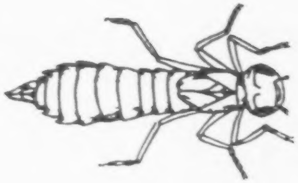




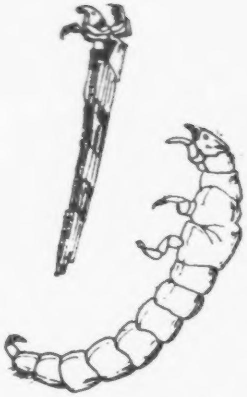
Osprey Hatchlings



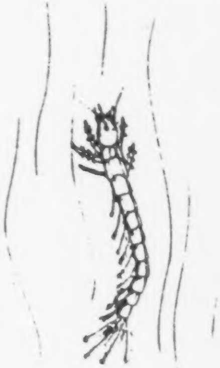
Stonefly Nymph



Dragonfly Nymph



Caddisfly Larvae



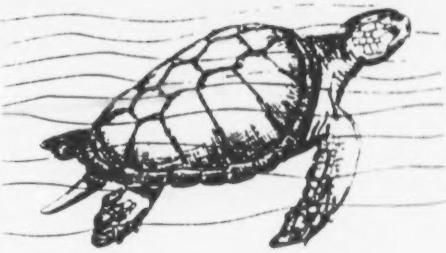
Whirligig Larva

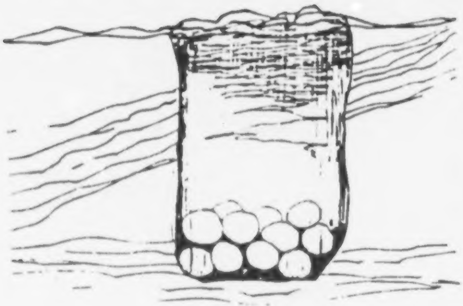
Frog

Duck

Butterfly

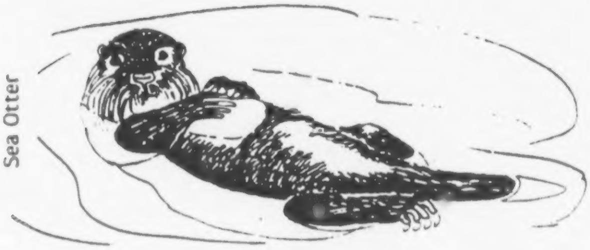
Sea Turtle

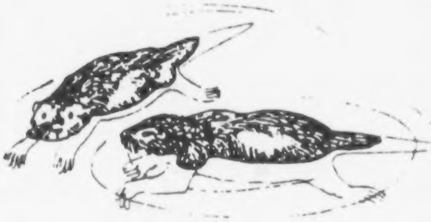




Sea Turtle Eggs

Sea Otter

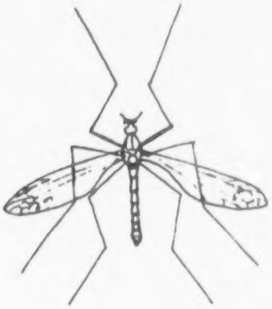


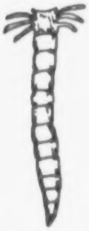


Young Sea Otters

18

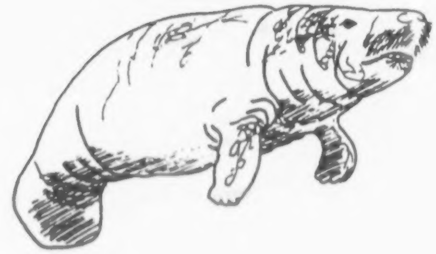
Cranefly

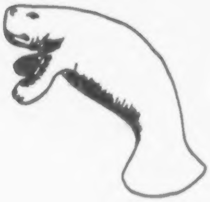




Cranefly Larva

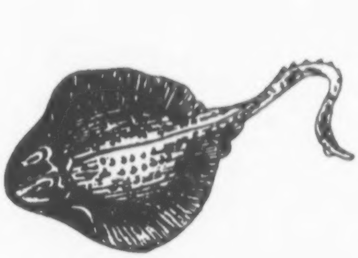
Manatee

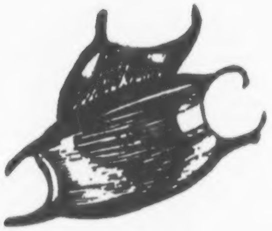




Young Manatee

Skate

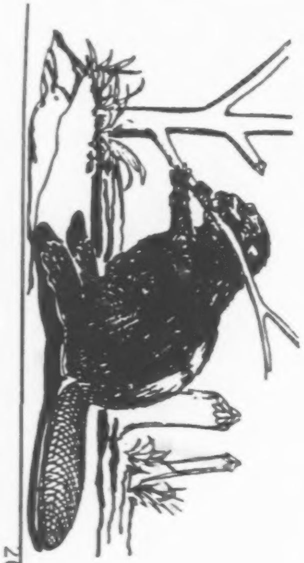


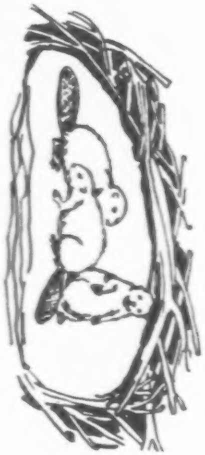


Skate Egg Cases

Skate Egg Cases

Adult Beaver

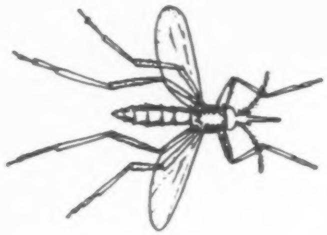


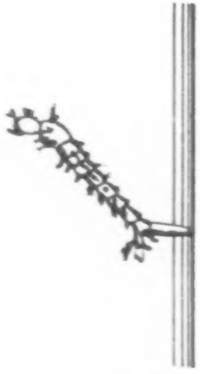


Young Beavers

Young Manatee

Mosquito

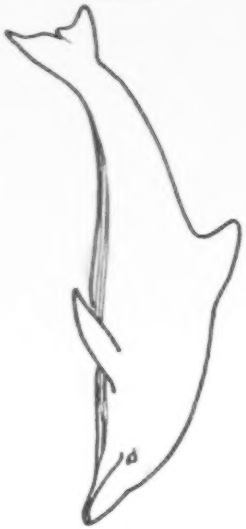


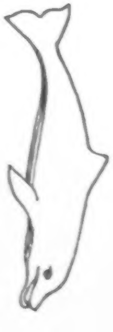


Mosquito Larva

Cranefly Larva

Porpoise

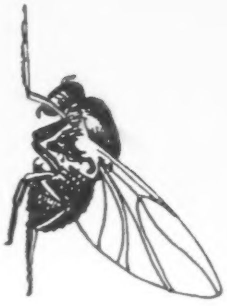


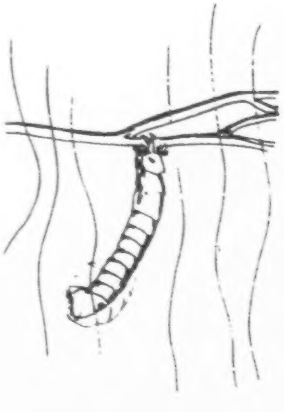


Young Porpoise

Young Sea OtterS

Black Fly

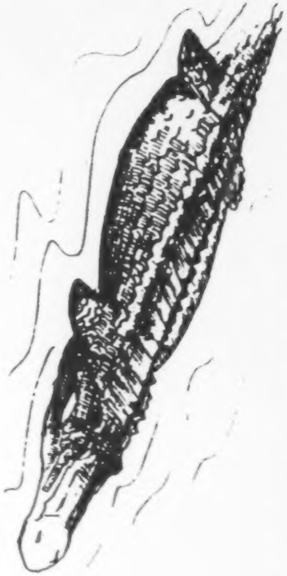


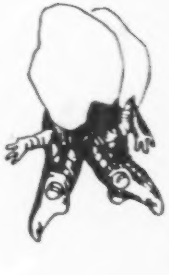


Black Fly Larva

Sea Turtle Eggs

Alligator





Alligator Hatchlings

TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME: Frances E. Beeson

INTERNSHIP: UTMB-Galveston

SCHOOL: Dickinson High School
Dickinson, Texas

PRIMARY SUBJECT: Biology, Physical Science

ACTIVITIES:

- Career Opportunities
- Oral Communication Skills
- Written Communication Skills
- Teamwork
- Problem Solving Skills
- Critical Thinking Skills

SUMMARY: See attached

RESOURCES:

Curriculum Implementation Plan

University of Texas Medical Branch.

OB-Gyn Department

Teacher: Frances E. Beeson
Mentor: Bogdan Nowicki, M.D., PhD.

The correlation of my summer internship and my class curriculum is expressed in three major ways. The first of these divisions is to further my previous summers research internship by developing a teaching unit for high school students that could adequately inform students about the major sexually transmitted diseases. The second division is to do research to determine if pyelonephritis is associated with low birth weight babies and pre-term labor. The third division is to use research skills so as to identify skills needed by my students in the work place.

Goals:

1. To increase student awareness of industries educational requirements.
2. To determine specific skills needed for employment in the work place
3. To expose students to a variety of career opportunities by bringing speakers to the school for realistic, relevant presentation's regarding employment opportunities in today;s work world.
4. To encourage students to pursue an advanced education in a scientific field or to be better suited for a career.
5. To enlighten students as to the need for a strong science and mathematics background.
6. To encourage analytical and critical thinking skills in students by identifying the value of these skills in industry and by providing an opportunity for their use in the laboratory.
7. To determine the level of knowledge that exist related to sexually transmitted infectious diseases.
8. To provide learning in three modes, auditory, visual and tactile kinetic , on the major sexually transmitted diseases.

9. To determine the level of knowledge present following the educational process regarding sexually transmitted infectious diseases.
10. To provide students with examples of problem solving, using the scientific method as it is related to the Pyelonephritis Experiment and how this could improve the quality of medical care as well as lower the cost of the medical care provided.

Strategies:

I. Career Opportunities
  A. Using a career survey, conduct a Cooperative Learning Lesson.
    1. Students will survey friends and family on employment opportunities, educational requirements and expected income.
    2. Students within a group will choose occupations and provide information as to skills needed, educational requirements, expected income, advantages and disadvantages of that particular career.
    3. Students will make displays and present findings on careers to classmates.
  B . Access the students knowledge of sexually transmitted disease by using the Questionnaire prior to teaching units on bacteria and viruses or reproduction, and provide needed educational opportunities.
    I. Administer Sexually Transmitted Infectious Disease Questionnaire as a pretest to teaching the chapters related to bacteria and viruses.
    2. Teach the unit provided on sexually transmitted diseases emphasizing cause, symptoms, treatment, prevention and affects of the specific diseases on the body.
    3. Use games to provide various modes of teaching.
    4. Retest with the same Sexually Transmitted Infectious Disease Questionnaire to determine if the students have expanded their knowledge.
  C. Using the pyelonephritis experiment, discuss ways that the scientific method is used on a daily basis in research and in problem solving.
    I. Show steps of Scientific Method.

2. Discuss what is done in each step of the Scientific Method

3. Evaluate methods of collection of data.
4. Demonstrate charting and record keeping in charting of data. Show charts made in data collecting for the Pyelonephritis Experiment.
5. Discuss drawing a conclusion from data collected. Show how trends are used to draw conclusions.
6. Provide an opportunity for students to use Scientific Method to solve an experimental problem in class.

D. Students will make VCR tapes on sexually transmitted diseases and/or authentic assessments.

II. Oral Communication Skills
- A. Presentation of data to class to be taped.
- B. Student evaluation of self and peers of VCR tapes they made.
- C. Responses to peers expressing strong points and weaknesses of peers and responding to guest speakers will provide opportunities to build oral communication skills and self confidence.

III. Written Communication Skills
- A. Students will write answers to exercises, quizzes, test and activities.
  1. Laboratory activities and project reports.
  2. Cooperative Learning Group written communication such as reports or charts.
  3. Authentic Assessment reports, displays, or hand out materials.
- B. Essays
  1. Laboratory data sheets on projects showing observations and conclusions.
  2. Answers to canned situations given on topics such as sexually transmitted diseases.

IV. Teamwork
- A. Students will take responsibility for specific tasks in authentic assessments.
- B. Students will be responsible for individual roles in Cooperative Learning Groups as well as the teams overall output and oral presentation.
- C. Students will actively work with partners in collection and recording of laboratory data.

V. Problem Solving Skills

A. Students will use problem solving skills (Scientific Method) to conduct a scientific experiment. They will experience modification techniques to find a solution to the problem so that a conclusion can be drawn.

B. Students will be organized into Cooperative Learning Groups to facilitate lab work. They will be taught to use methods such as fish-boning, 6-4 vote to solve problems and will have specific task to preform.

VI. Critical Thinking Skills

A. Students will develop skills in modifying experiments to meet changing conditions in projects or laboratory activities.

B. Students will develop skills in modifying equipment or data to meet the needs of the experiment .

C. Students will adapt ways to improve production, methods and efficiency in the laboratory or in games by utilizing their partners capabilities.

Summary:

Pre-term labor and low birth weight babies are major problems causing personal anguish, pain, and major medical cost. It occurs in eight percent or 350,000 cases per year in the United States alone. Urinary tract infections including severe kidney infections (Pyelonephritis) is among the most frequent complications in pregnant individuals. Pyelonephritis seems to be associated with high risk pregnancy complications resulting in pre-term labor. E. coli virulence including type of endotoxin and specific fimbriae type may predispose microorganism to cause severe infection in pregnant females. A high percentage have no or limited prenatal care. The risk may be lessened with prenatal care. If predictions can be made as to the complications that are likely to arise and treatment can be given, then perhaps pain, anguish, spontaneous abortions might be lessened while medical cost would decrease.

As a Summer Research participant in Summer 1992, I concluded from the survey that 15-17 year old groups missed the most questions related to the highest incidence of sexually transmitted disease and that this group was seen more often at pregnancy clinics. This meant they were also more likely to be exposed to sexually transmitted diseases. It seemed obvious that the learning needed to occur early, before age 15. During the winter of 1992-1993, I deligently pursued the teaching and encouraging others to teach about sexually transmitted diseases. I ask the Drama Department at our school to preform a production on AIDS which was well received. A plea I often heard was, I'm willing to teach this and I know it needs to be done but I need information and easy access to materials. It is hoped that the Unit provided here will satisfy this need. It includes teacher information, student overhead transparencies, games and pre and post test. Let's work together to try to make a difference!

TEXAS AND U.S.
ADOLESCENT GONORRHEA & SYPHILIS CASES AND RATES

TEXAS - GONORRHEA

YEAR	AGE 10-14	% OF TOTAL	AGE 15-19	% OF TOTAL	TEXAS TOTAL
1970	338	0.8%	9,973	23%	43,601
1980	540	0.7%	19,469	24%	80,297
1985	627	0.9%	15,912	24%	66,728
1986	722	1.1%	15,888	25%	63,376
1987	495	1.0%	13,402	26%	51,688
1988	490	1.1%	11,791	26%	45,639
1989	577	1.3%	12,565	27%	45,786
1990	627	1.5%	12,490	29%	43,231
1991	766	1.8%	12,914	30%	43,282

U.S. - GONORRHEA

					U.S. TOTAL
1980	8,873	0.8%	247,239	25%	1,004,029
1985	8,164	0.9%	218,821	25%	910,895
1986	8,088	0.9%	215,707	24%	892,229
1987	7,041	0.9%	188,233	24%	780,905
1988	10,701	1.5%	195,312	27%	719,536
1989	11,820	1.6%	204,023	28%	733,151
1990*	11,020	1.7%	183,865	28%	653,835

TEXAS - SYPHILIS**

YEAR	AGE 10-14	% OF TOTAL	AGE 15-19	% OF TOTAL	TEXAS TOTAL
1970	32	1.1%	562	20%	2,804
1980	36	0.9%	546	14%	3,828
1985	29	0.6%	511	12%	4,610
1986	21	0.5%	444	12%	3,967
1987	18	1.0%	398	13%	3,071
1988	20	0.6%	334	11%	3,124
1989	26	0.6%	476	11%	4,267
1990	37	0.7%	599	12%	5,165
1991	31	0.6%	607	12%	4,970

U.S. - SYPHILIS**

					U.S. TOTALS
1980	168	0.6%	3,574	13%	27,204
1985	159	0.6%	3,132	12%	27,143
1986	168	0.6%	3,264	12%	27,667
1987	229	0.7%	4,331	12%	35,147
1988	169	0.4%	3,969	10%	40,117
1989	216	0.5%	4,408	10%	44,540
1990*	303	0.6%	5,184	10%	50,155

* Most current statistics available

** Primary and secondary stage syphilis only

NOTE: DIAGNOSED CASES OF CHLAMYDIA ARE ALARMINGLY HIGH AND PROBABLY RIVAL THOSE OF GONORRHEA. DUE TO TESTING AND FINANCIAL LIMITATIONS, DIAGNOSIS OF CHLAMYDIA IS DIFFICULT. MOST EXPERTS AGREE THAT THE NUMBER OF ACTUAL CASES IS SIGNIFICANTLY HIGHER THAN IS GENERALLY REPORTED IN BOTH TEXAS AND THE U.S.

(03/92)TDH

Acute Agent Abstinence AIDS

Alopecia Anus

Amniotic Fluid Anorectal

Antibiotic Antigen Asymptomatic

Bacteria Benign

Bartholin's Glands Bimanual

Examination

Bladder Candidiasis Carrier

Cervix Chancre Chlamydia

Chronic Clap

Clinical Manifestations Clitoris

Coitus Communicable Disease

Condom Congenital Conjunctivitis

Contact Contagious Condyloma

latum Copulation Cowper's Glands

Culture Cunnilingus Diagnosis

Disseminated Gonococcal Infection or

DGI Duct Dysuria Effusion

Ectopic Pregnancy Endemic

Endocervical Endocarditis

Epidemic Epidemiology Fetus

Epididymis Exposure Exudate

Fallopian Tubes Fellatio Flora

FTA-ABS Fungus Genito-urinary

Genital Genitalia Gonococcus

Groin Gonorrhea Gumma

Hemorrhagic Hepatosplenomegaly

Herpes Host Human

Disease Pelvis Penicillin
Pericarditis Prevalence
Peri Hepatitis Prostate Gland
Pharyngeal Gonococcal
Prophylactic Treatment
Prophylaxis Protozoa Pustules
Rectum Resistance Scrotum
Rhagades Semen Seminal
Vesicles Septic Sexually
Transmitted Disease (STD)
Sign Spirochete Stage Sterility
Symptom Symptomatic Syphilis
Systemic Synovial Fluid Testes
Treponema Pallidum

Immunodeficiency Virus (HIV)
Immunity Incidence Incubation
Period Infection Inguinal Area
Inoculate Immunocompetence
Intracellular Latent
Intercourse Labia majora Labia
minora Lesion Lymphadenopathy
Malodorous Lymph Gland (Node)
Morbidity Mortality Mucous Membrane
Mulberry Molar Necrosis Neisseria
Gonorrhoeae Neonatal Ovary
Non-Gonococcal Urethritis (NGU)
Pandemic Pap Smear Parasite
Pathogen Pelvic Inflammatory

latum Copulation Cowper's Glands

Culture Cunnilingus Diagnosis

Disseminated Gonococcal Infection or

DGI Duct Dysuria Effusion

Ectopic Pregnancy Endemic

Endocervical Endocarditis

Epidemic Epidemiology Fetus

Epididymis Exposure Exudate

Fallopian Tubes Fellatio Flora

FTA-ABS Fungus Genito-urinary

Genital Genitalia Gonococcus

Groin Gonorrhea Gumma

Hemorrhagic Hepatosplenomegaly

Herpes Host Human

Trichomoniasis Urethra Uterus

Vaccine Vaginitis Vas Deferens

Venereal Diseases Vesicle

Virulence Virus Vulva Yeast

NAME__________________________UH#__________AGE______

PLEASE ANSWER THE FOLLOWING QUESTIONS AS TRUE AND FALSE

STD Questionnaire

_____1. Syphilis can cause stillbirth.

_____2. Once you have syphilis and are treated, you can never have syphilis again because you now have an immunity to it.

_____3. You are more likely to get syphilis if you have more than one sex partner.

_____4. The first symptom of syphilis is a painless sore or blister which appears 10 to 90 days after contact with an infected person.

_____5. The symptoms of syphilis are always present until treatment has been completed.

_____6. Early treatment of syphilis is the most effective way to prevent long-term complications.

_____7, The early stages of syphilis may go unnoticed.

_____8. Syphilis may be treated effectively with antibiotic injections.

_____9.. It is NOT necessary for your sex partner to be treated for syphilis as you can't be reinfected.

_____10.. Sex is allowed in all forms during the treatment period for syphilis.

_____11, Follow up appointments with the doctor are necessary to make sure the syphilis infection is completely gone.

_____12, A condom is always effective for the prevention of syphilis.

_____27. You may be tested for chlamydia even if you have no symptoms, if you are in the high-risk group.

_____28. Chlamydia usually infects persons over 30 years of age.

_____29. Sixty percent of the women who are infected with gonorrhea have no symptoms, thus may be unknown carriers of the disease for many months.

_____30. Young girls and babies cannot get gonorrhea.

_____31. Symptoms of gonorrhea in males include painful or difficult urination and a pus like discharge from penis.

_____32. Women who have gonorrhea should encourage their partner to get tested.

_____33.. Gonorrhea may cause stiff and painful joints and muscles.

_____34. Gonorrhea isn't really harmful, because you never have serious complications or die from it.

_____35. Persons being treated for gonorrhea must take antibiotics and not drink alcohol for at least two weeks.

_____36. When it is determined that you have gonorrhea, it is essential that all sexual contacts be examined and given treatment. as many of them may be unaware that they have the disease.

_____37. It is O.K. to have sex the night after you have your shot of antibiotics for chlamydia, as you are no longer contagious.

_____38. Estimates are that 2 million cases of gonorrhea occur in the U.S. each year with 75 % of these infecting women 15-24 years old.

_____39. Gonorrhea isn't very contagious and chances are you probably wouldn't get infected by having sex just once.

_____52. Genital herpes is a sexually transmitted disease.

_____53. Genital herpes infections are usually continuous rather than episodes.

_____54. Genital herpes are never associated with the presence of other sexually transmitted diseases.

_____55. Genital herpes may be acquired from a sex partner with no symptoms.

_____56. The highest frequency of genital herpes is in the 15 to 29 year old age group.

_____57. Symptoms of first episode genital herpes are painful lesions, fever, headaches and nausea.

_____58. Diagnosis of genital herpes should be determined by a doctor performing viral culture laboratory test.

Would you be interested in further information on sexually transmitted diseases?

Have you ever had a sexually transmitted infectious disease?
Yes or No (Circle One)

NAME__

PLEASE A

T 1.
F 2.
T 3.
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F 51.

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F 5
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T 5
T 58

Is pyelonephritis in pregnancy a risk factor for preterm labor?

Frances E. Beeson and Audrey Hart
Preceptor: Bogdan Nowicki, MD, PhD

The University of Texas Medical Branch at Galveston

Beeson 56

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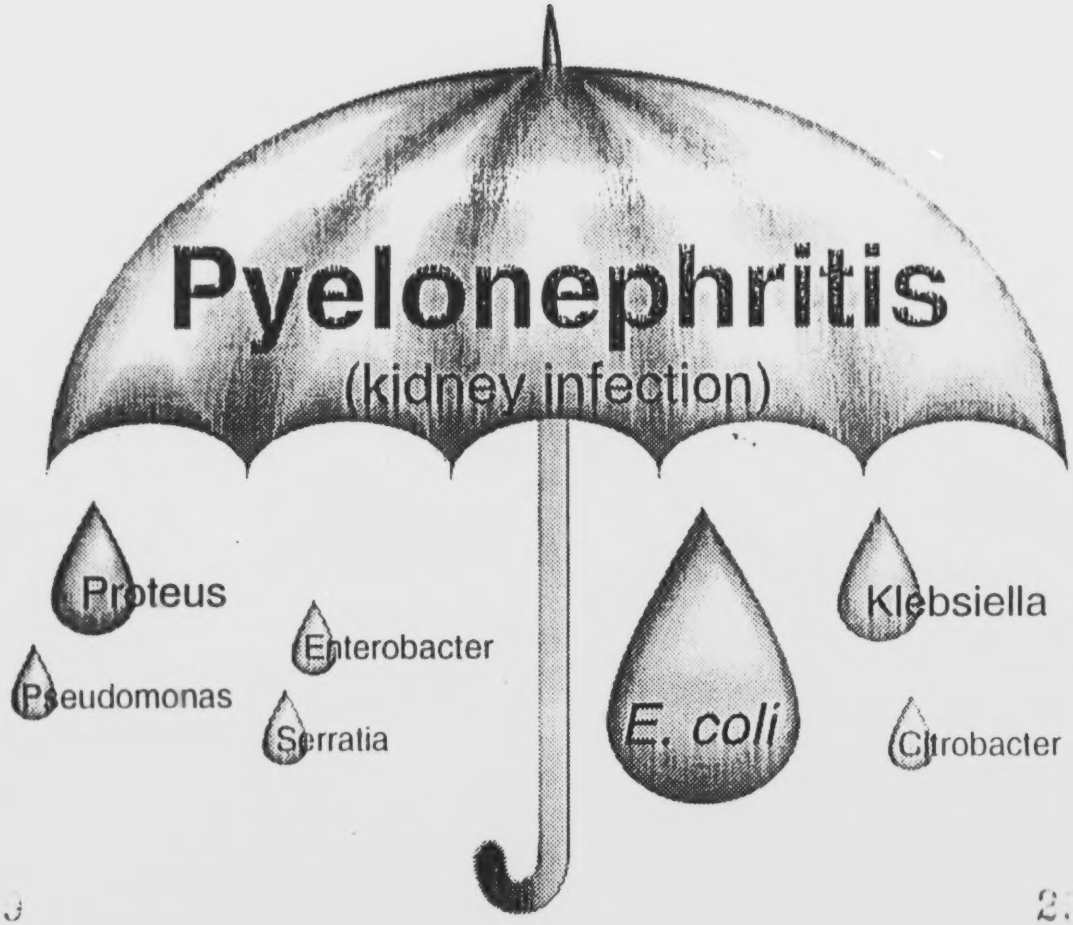

Pyelonephritis

(kidney infection)

Proteus

Pseudomonas

Enterobacter

Serratia

E. coli

Klebsiella

Citrobacter

Beeson 5

TITLE: Is pyelonephritis in pregnancy a risk factor for pre-term labor?
by Frances E. Beeson and Audrey Hart
Preceptor: Bogdan Nowicki, M.D., PhD

INTRODUCTION: Pre-term labor (PTL) is a major problem in both the industrial and the third world countries. It occurs in the United States in eight percent of the pregnancies. This rate translates into 350,000 cases per year in our country alone. Infections account for about twenty percent of the cases involving pre-term labor. Urinary tract infections (UTI) including severe kidney infections called pyelonephritis, is among the frequent complications in pregnant individuals.

HYPOTHESIS: Is pyelonephritis associated with PTL/Low birth weight babies in the sample group at UTMB?

MATERIALS AND METHODS. The population tested included sixty pregnant females that developed pyelonephritis during pregnancy. The following clinical characteristics were investigated:

(1) Clinical microbiology included identification of bacterial isolates. Since ninety percent of the cases were caused by Escherichia coli (E. coli) strains. These isolates were tested for O serotype (LPS endotoxin), virulence factors such as fimbriae, hemolysin and invasiveness.

(2) Medical records with clinical lab findings including PTL and low birth weight were investigated and charted as to results, complications and outcome of the pregnancy.

RESULTS: Table 1

Table I: Frequency of preterm labor and/or low birth weight (LBW) in pregnant patients with pyelonephritis

	PTL ≤37 wks	LBW ≤2.5 kg	Both PTL/LBW	Normal
Number of patients	7	4	8	33
Percent	14%	8%	15%	63%

Frequency (occurrence) of PTL/LBW in this study: Pyelonephritis exists at least two to three times higher than national averages (37% versus 8 to 8.5%)

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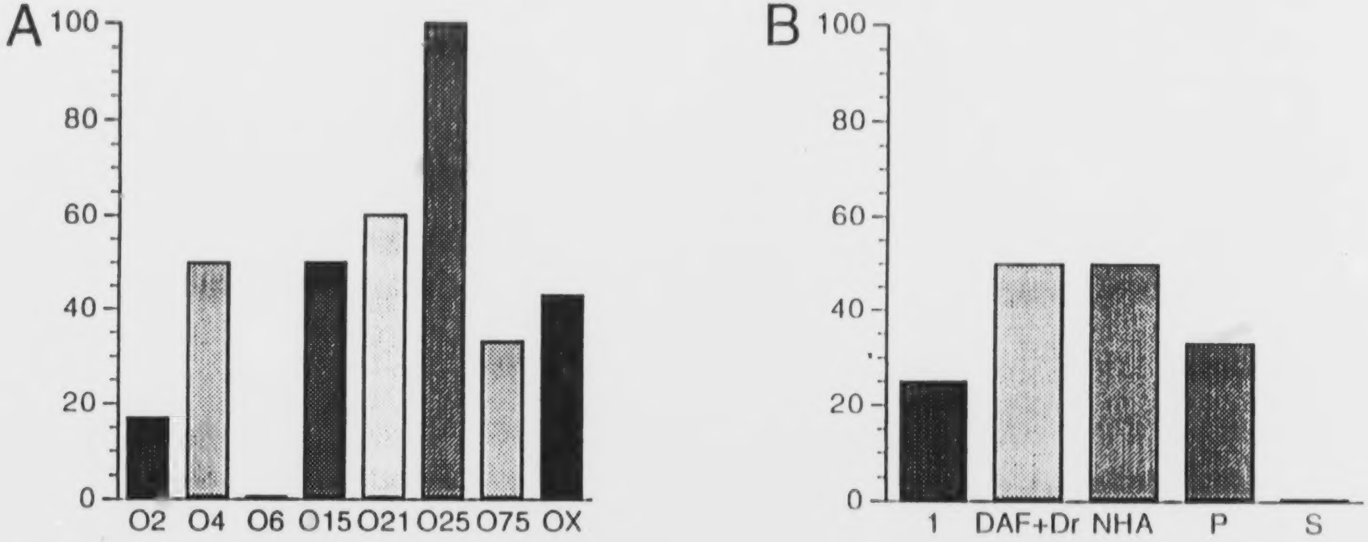
Figure 2: Association between biological characteristics of bacterial organisms and the outcome of pregnancy



2A: O serotypes (endotoxins). There are 173 O serotypes of *E. coli* known. Of these, 10 specific serotypes—O1, O2, O4, O6, O7, O8, O9, O16, O25, and O75—are associated with pyelonephritis. Type O6 is the most virulent in nonpregnant females. In pregnant females, there are 0% complications. Other types—15, 21, 25, 75, X, and OX—are the unknown serotypes detected at UTMB. These may indicate high-risk strains of the bacteria. With early detection, we may be able to predict which ones will lead to pregnancy complications.

2B: Fimbriae. There is a correlation with the *E. coli* virulence factor. DAF fimbriae positively correlates with preterm labor.

Beeson 60

CONCLUSION:

1. Pyelonephritis seems to be associated with high risk pregnancy complications resulting in pre-term labor.
2. E.coli virulence including type of endotoxin and specific fimbriae type may predispose microorganism to cause severe infection in pregnant females resulting in pre-term labor and/or low birth weight babies.
3. A high percentage of the patients in the test population had no or limited prenatal care, this may account for the increase risk of pregnancy complications including pyelonephritis.

PATIENT MEDICAL RECORD WORK SHEET

NAME: ____________________ **UH#:** ______________

SPECIMEN COLLECTION DATE: ____________ GESTATION: ________

MEDICAL HISTROY:(Diabetic, etc.) ______________________________

____

____

CLINICAL SYMPTOMS:

Lowest hematocrit ________ HGB ______________

WBC ______________ Tmax ______________

Sediment. Rate __________ CRP ______________

DELIVERY OUTCOME:

Birth weight ____________

Apgar Score ____________

Gest. Week ____________

Complications ______________________________________

ADDITIONAL COMMENTS ______________________________

____

____

____

Conclusions

1. Pyelonephritis seems to produce high-risk pregnancy complications resulting in preterm labor.
2. *E. coli* virulence, including type of endotoxin and specific fimbriae type, may predispose microorganisms to cause severe infections in pregnant females, resulting in preterm labor and/or LBW babies.
3. A high percentage of patients in the test population had limited or no prenatal care, which may account for the increased risk of pregnancy complications that include pyelonephritis.

TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME: Otis Carrell

INTERNSHIP: UTMB-Galveston

SCHOOL: La Marque High School
La Marque, Texas

PRIMARY SUBJECT: Chemistry

ACTIVITIES:

- To Determine the Structure of a Phage Virus
- To Count the Plaques
- To Learn Techniques of Bacteriology
- To Observe Effect of a Phage

SUMMARY:

RESOURCES: Dr. Sam Baron, Chairman Immunology & Virology
University of Texas Medical Branch at Galveston
Galveston, Texas 77555
409-772-2324

BACTERIAL VIRUSES

Material Needed:

1. Glass Marking Pencil
2. Bacterial Loop
3. Test Tubes
4. Stock Culture of Sreptococcus Faecalis
5. Stock Culture of Streptococcus Foecalis Phage
6. Incubator that will calibrate to 37 degrees Celsius
7. S F Broth
8. Bunsen Burner
9. Test Tube Rack
10. Sterile Cotton Plugs

Objectives:

1. To determine the structure of a Phage Virus
2. To count the Plaques
3. To learn techniques of Bacteriology
4. To observe effects of a Phage

Problem: What is the structure and composition of the virus and how does it destroy a bacterium?

Only certain kinds of bacteria will be invaded by a bacterial virus. The electron microscope, which magnifies 100,000 times or more, is a valuable tool. It enabled biologists to determine the structure of Bacteriophages during the lytic cycle, a phage will destroy bacteria in six steps. The steps are normal bacterium, phage attaches, phage DNA forced through the cell wall, phage DNA reorganizes DNA and protein synthesis builds more phage DNA, bacterium builds more virus particles, cell wall breaks, liberating phages.

Procedure:

Part 1

Examine the stages of the Lytic Cycle shown on the data sheet. Refer to your text if you need help to explain each stage in the cycle.

Part 2

The results of the Streptococcus Faecalis Phage on the bacteria growth in a broth will be observed. The bacterium is found in the intestine of the human as well as polluted water. Brom Cresol Purple and Dextrose will be used as an indicator. When the bactera grow, Lactic Acid will be produced. The purple indicator changes to a yellow color. If a Bacteriophage Lyses the bacteria, therefore, an acid is not produced. Thus the broth will remain purple.

1. Mark two teast tubs C and F.
2. Pass the loop through the flame until it become red hot.
3. When it is cool, then transfer one loop of the Streptococcus Faecalis Bacteria from the stock solution to the control tube that is marked C.
4. Then again flame the loop. Let it cool. Then transfer a loop of Streptococcus Faecalis from the stock solution to the tube F, which is the experimental tube.
5. In the thirty seven degree celsius incubator, place both the controal and experimental tubes. After twenty four hours examine the tubes. Do the same after forty eight hours.

TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME: Barry Gray

INTERNSHIP: UTMB-Galveston

SCHOOL: Clear Lake High School
Houston, Texas

PRIMARY SUBJECT: Physics

ACTIVITIES: Using the Human Body as a Physics Laboratory

SUMMARY:

RESOURCES:

Using the Human Body as a Physics Laboratory

by
Barry Gray
physics teacher
Clear Lake High School
Summer 1994
The University of Texas Medical Branch, Galveston, Texas
Texas Teacher Internship Program
Dr. Wm. L. Buford, Mentor, PhD. Biomechanical Engineering
Texas Alliance for Science, Technology & Mathematics Education
Texas A & M University, EDCI, College of Education
Brian T. Walenta, TTIP Project Coordinator

In these days of large classes and small budgets it is nice to know that each student is actually carrying around with them an excellent physics laboratory. I am, of course referring to the human body. One of the objectives of this project is to help science teachers take advantage of this built in lab by showing the relationships between the subjects of physics and biology. Today, more than ever, it is necessary that the school make the student's education as relevant as possible, not only to keep more students in school but to make their classes interesting and possibly even enjoyable. I hope to accomplish this through a number of activities, projects and information. This project is not intended to "*add one more thing to the teacher's already overcrowded day*," but rather to do three things: (1) to give the teacher some new ideas that could be used to teach a concept better, (2) to substitute for an activity that doesn't seem to be working too well, and (3) to give the teacher some basic information so that they can create some activities of their own.

The area of science that actually relates physics to the human body is called *Biomechanics*. This project will use many of the principles of biomechanics to create some interesting and relevant learning experiences for the students, introduce them to the field of *Biomechanical Engineering* and, hopefully, make the teacher's life a little less stressful.

Biomechanical Engineering: What is It?

Biomechanical engineering is the science of using the principles of physics to better understand the human body. It is a part of the broader field of bioengineering and is particularly important in the area of orthopaedics. It applies classical and fluid mechanics to biological problems. Area of physics such as statics and dynamics are used to help the doctors better understand the human body so that they can make better diagnoses.

"*Biomechanics* is a discipline utilized by different groups of professionals. It is a required basic science for orthopaedic surgeons, physiatrists, rheumatologists, physical and occupational therapists, and athletic trainers. These medical and paramedical specialists usually do not have a strong mathematics and physics background."(1 :p xv) Consequently, biomechanics must be presented to them in a rather non-mathematical way so that they may learn the concepts of mechanics without a rigorous mathematical approach. Junior high and high school science students for the most part would also fall under this description.

Students who are preparing for careers in human factors engineering, ergonomics, biomechanics research, prosthetic research and development as well as any of the health science related fields would do well to have had some exposure to the physics principles that relate to how the human body works.

"*Biomechanics* combines the field of engineering mechanics (physics) with the fields of biology and physiology. Biomechanics is concerned with the human body. In biomechanics, the principles of mechanics are applied to the conception, design, development, and analysis of equipment and systems in biology and medicine. Although biomechanics is a relatively young and dynamic field, its history can be traced back to the fifteenth century, when Leonardo da Vinci (1452-1519) noted the significance of mechanics in his biological studies. As a result of contributions of researchers in the fields of biology, medicine, basic sciences, and engineering, the interdisciplinary field of biomechanics has been growing steadily in the last two decades.

The development of the field of biomechanics has improved our understanding of many things, including normal and pathological situations, mechanics of neuromuscular control, mechanics of blood flow in the microcirculation, mechanics of air flow in the lung, and mechanics of growth and form. It has contributed to the development of medical diagnostic and treatment procedures. It has provided the means for designing and manufacturing medical instruments, devices for the handicapped, artificial replacements and implants. It has suggested the means for improving human performance in the workplace and in athletic competition.

Different aspects of biomechanics utilize different components of applied mechanics. For example, the principles of statics are applied to determine the magnitude and nature of forces involved in various joints and muscles of the musculoskeletal system. The principles of dynamics are utilized for motion description and have many applications in sports mechanics. The principles of the mechanics of deformable bodies provide the necessary tools for developing the field and constitutive equations for biological materials and systems, which in turn are used to evaluate their functional behavior under different conditions. The principles of fluid mechanics are used to investigate the blood flow in the human circulatory system and air flow in the lung." (1 :p 5)

"Engineering mechanics is based on Newtonian mechanics in which the basic concepts are length, time and mass. These are absolute concepts because they are independent of each other. Other important concepts in mechanics are not absolute but derived from these basic concepts. These include force, impulse, moment of torque, velocity, acceleration, work, energy, power, momentum, stress and strain." (1:p 6)

Some of the areas in biomechanics where we can apply the static laws of physics that are: skeletal joints, skeletal muscles, mechanics of the wrist, elbow, shoulder, spinal column, hip, knee and ankle. The laws governing dynamic systems can be applied to kinematics and kinetics, linear, angular and general motion, particle and rigid body mechanics, reference frame and coordinate systems, distance and displacement, velocity and acceleration, and force and torque.

Biomechanics could be a very useful tool for the high school science teacher in showing the relationships between the subjects of biology, physical science, physics, and to some degree, chemistry, and hopefully make each more interesting for the student. By making these subjects more interesting and relevant the student will hopefully learn more and retain the information longer. The activities that follow are not intended to add more material for the teacher to teach but rather are designed to be substituted for activities that are already being done or to give the teacher new ideas that will supplement and reinforce topics already being taught. Depending on the level of the students and the type of subject being taught the teacher many choose to use only a few of these ideas and omit the rest. Only a relative few activities are presented here but there is also a lot of information (diagrams, etc.) from which the teacher can be creative and come up with his own ideas for more activities and projects. Some of the math examples may be beyond the abilities of biology and physical science students. The activities are not designated 'Biology', 'Physical Science,' etc. so that each teacher may choose whichever ones they would like for their students to do. Although this project is designed primarily for the physics teacher the chemistry teacher should be able to get some good ideas for research topics.

Vocabulary and Definitions

Here is a list of key words of interest in therapy, biomechanics, orthotics and prosthetics. Understanding the measurement terms, in particular, is very important to anyone who will be taking data for a science project such as for the science fair.

Terms:

Measurement terms:

- **objectivity**
- **subjectivity**
- **accuracy**
- **resolution**
- **reproducibility**
- **sensitivity**
- **frequency analysis**
- **statistical control**

Biomechanical materials and testing terms:

- **elasticity**
- **plasticity**
- **viscosity**
- **stress**
- **tension**
- **compression**
- **shear**
- **soft tissue**
- **deformation**
- **force**
- **pressure**
- **torque (moment)**
- **hysteresis**
- **relaxation**
- **viscoelasticity**
- **translational motion**
- **rotational motion**

Definitions:

Objective test **- a test or procedure whose result is independent of personal feelings or prejudices. It exists outside and independent of the mind.**

Subjective test **- one whose result is dependent upon the mind.**

Accuracy **- a measurement of the closeness of a measurement to the true value. It is the true value minus the measured value, and this difference is divided by the true value (usually expressed in percent). It is also a measure of the total error without regard to the type of source of the error, and since true values are seldom available, the accepted true value or reference value should be traceable to the National Bureau of Standards.**

Precision of a measurement - an expression of the number of distinguishable alternatives from which a given result is selected. Example: a meter that displays 98.2~4 degrees is more precise than one which displays 98.2, however, the former may be the less accurate.

Resolution - the smallest incremental quantity that can be measured with certainty. If the measured quantity starts from zero, the term threshold is synonymous with resolution.

Reproducibility (repeatability) - the ability of a measurement device to give the same output for equal inputs applied over some period of time. It does not imply accuracy. For example, an unplugged clock gives very reproducible values that are accurate only twice a day.

Sensitivity - the slope of the input Vs output curve for a given measurement device. A highly sensitive instrument will have a large change in the output for a small change in input.

Frequency analysis - measurement which considers the variation in frequency of measured phenomena. All dynamic variables constitute such phenomena.

Statistical control - exists when random variations in measured quantities that result from all factors that influence the measurement process are tolerable. Any systematic errors or bias can be removed by calibration and correction factors, but random variables pose a more difficult problem. The measurer and/or the instrument may introduce statistical variations that make outputs unreproducible. If the cause of this variability cannot be eliminated, then statistical analysis must be used to determine the error variation. The estimate of the true value can be improved by making multiple measurements and averaging the results.

Biomechanic terms:

Elasticity - the tendency of a material to return to its original shape after deformation.

Plasticity - the capacity of a material for being shaped or molded.

Viscosity - that property by which a fluid offers resistance to shear stress.

Stress - the resultant internal force that resists change in the size or shape of a body acted on by external forces.

Tensile stress or tension - the internal force that resists the action of external forces tending to increase the length of a body.

Compressive stress or compression - the internal force that resists the action of external forces tending to decrease the length of a body.

Shearing stress or shear - the internal force acting along a plane between adjacent parts of a body when two equal forces parallel to the plane act on each part in opposite directions.

Normal stress - one that acts perpendicular to the section of material considered.

Axial stress - exists when the resultant of applied loads coincides with the axis of the section i.e. along the length of a bone.

Deformation - the amount of the change in shape of a body caused by the application of external forces.

Strain or unit deformation - the total amount of deformation divided by the original length.

Force - that which changes the state of rest or motion in matter, measured by the rate of change of momentum. Force has magnitude, direction and a point of application.

Pressure - force distributed over a surface expressed as force per unit area.

Torque or moment - the effectiveness of a force to produce rotation about a point (axis). It is expressed as the product of the force magnitude and the perpendicular distance from the point of rotation (moment arm).

Hysteresis - this results when some of the energy applied to a material for an increasing input is not recovered when the input decreases.

Relaxation - when a material is suddenly strained and then the strain is maintained constant afterward, the corresponding stresses induced in the material decrease with time.

Creep - when a material is suddenly stressed and when the stress is maintained the material continues to deform.

Viscoelastic materials - are those which exhibit hysteresis, relaxation and creep.

Translational motion - to move an object from one location to another

Rotational motion - to move an object about some axis

Activities and Projects

1. *Ratios:* Have students trace around one of their hands on a sheet of paper, being sure to note and mark each joint. They can then draw and label the bones using Fig. 1 as a guide. Have them determine the ratios of the length of each bone in each of their fingers to the overall length of their fingers.

2. *Volume:* They can determine the volume of their hand up to the wrist by submerging their hand in a container and measuring the volume of overflow.

3. *Bones of the Hand:* Using a copy of Fig. 1 and Fig. 2 they can identify the bones of the palmer side and of the dorsal side of the hand.

4. *Bones of the Wrist:* Using a copy of Fig. 86 they can identify and label the bones of the right wrist and hand.

5. *Muscles of the Palm:* Using a copy of Fig. 147 they can identify and label the muscles of the palmar aspect of the right hand.

6. *Nerves of the Hand:* Using a copy of Fig. 277 they can identify and label the nerves of the right hand.

7. *Secondary Muscles of the Hand and Wrist:* Using a copy of Fig. 148 they can identify and/or label the secondary layer of muscles of the right wrist and hand.

8. *Deep Muscles of the Palm and Wrist:* Using a copy of Fig. 149 they can identify and/or label the deep muscles of the right wrist and hand.

9. *Superficial Muscles of the Back of the Hand:* Using a copy of Fig. 150 they can identify and/or label the superficial muscles of the back of the right hand.

10. *Deep Muscles of the Back of the Hand:* Using a copy of Fig. 151 they can identify and/or label the deep muscles of the back of the right hand.

11. *Tendons of the Finger:* Using a copy of Fig. 152 they can identify and/or label the tendons of the finger.

12. *Degrees of Freedom:* Using their own hands they can determine (a) the degrees of freedom of each finger and the total number of *degrees of freedom* for the whole hand. In order to keep it fairly simple we will use the longitudinal axis of each bone. Degree of freedom is defined as the ability to move in a certain direction or plane. For example the first two bones in your finger have only one degree of freedom while the proximal bone has two. (i.e. can move in the horizontal and vertical plane. Your whole finger would therefore have a total of four degrees of freedom. Based on these criteria, the hand should have 21 degrees of freedom. Using their own bodies they are to determine how many degrees of freedom they have in their (a) shoulder, (b) elbow, (c) ankle, (d) wrist, (e) hip and (f) their knee.

13. *Joints:* Have them compare and contrast the types of joints found in the hip or shoulder joint with that of the knee or elbow.

14. *Mechanics of the Arm and Hand:* Working in groups have the students construct a ***robotic arm*** (with hand) that works independently of gravity and can perform some task such as pick up a tuna fish can and place it somewhere else. The arm and hand may not contain any part that was originally made for a robot, i.e. Robotix, Capsula, etc. The students must operate their arm from behind a line and must reach out and pick up a tuna fish can that is located four feet from the base line. They must pick it up and move it 60 degrees to the right and place it on a target that is two feet from the base line. Extra credit is given for every 100 grams that the arm can lift up to a maximum of 1 kilogram. These masses are placed in the can. (This could be a six weeks type project.) Like a real arm and hand this project illustrates many physics concepts such as torque, moment arm, force just to name a few.

15. *Mechanics of the Finger:* Working in a group have them construct one finger that operates as much like a real finger as possible. This could also be a major group project. This would be a very good project to relate physics to biology.

16. *Vertical Stress (Bones):* Divide students into groups of from 3 to 5. Give each student one sheet of typing paper and one foot of one-inch masking tape. Be sure you know the weight of four sheets of typing paper and four feet of masking tape before starting the lab. Have them fold the paper in half so that the paper is now 5 1/2 by 8 1/2 inches. Now have them carefully roll it up into a column that is *exactly* one inch in diameter. They may use their piece of tape in any manner they wish. They MAY NOT use any more paper or tape. Now have

each group select the best four columns in their group. These will be the legs of their building. Have them place the legs in a square on the floor and begin stacking text books on the legs. Continue stacking until the legs collapse. Do not count the book that causes them to fall. It is not unusual for the columns to hold 15 to 20 books. Be sure you know the weight of the text books by weighing one prior to starting the activity. Divide the total weight of the books by the weight of the four sheets of paper. It is not unusual to get ratios of around 2000:1. This is a very good demonstration of vertical strength. In a discussion either before or after the lab you can relate the columns to the bones in the leg as well as columns that support houses, etc. The students are always very impressed with this lab but keep an eye on the more competitive students they sometimes tend to bend the rules a little.

17. *Mechanical Advantage and Efficiency:* The greater the mechanical advantage of a system the less force it has to exert in order to move a greater load. Mechanical advantage and efficiency can be demonstrated and calculated using pulleys but see saw, lever type demonstration would be more appropriate here to simulate how the arm works. All you would need is a pencil for a fulcrum, a stiff ruler and something to act as a load. A more elaborate demonstration or lab can be done using meter sticks, meter stick stand, and various masses that can be attached to the meter stick at any location. You can easily show how for example, a mass of 25 g can balance a mass of 50 g if the 25 g is placed twice as far from the fulcrum. *Mechanical advantage* can be calculated by dividing the force by the distance the load is from the fulcrum. It can also be calculated by dividing the distance the applied force moved by the distance the load (object) moved. The *efficiency* can be calculated by dividing the Work Output by the Work Input. This is done by dividing the product of the load times the distance it moved (Work Output) by the product of the applied force by the distance over which it was applied (Work Input). The percent can be calculated by multiplying this answer by 100. Power can also be calculated by dividing the work products by the time it took to do the work. The physics concepts involved here are: torque or moments, work, power, mechanical advantage, leverage and efficiency.

18. *Viscosity:* Many fluids in the body act as shock absorbers (such as the fluid in the joints) based on their viscosity properties. The more viscous a fluid, the denser it is and the more it resists changes (i.e. inertia). An experiment could be designed were various fluids (water, syrup or various motor oils) could be put in syringes and forces applied to the syringe's plunger. A good demonstration or lab could be build around the different effects a force applied over a long period of

time differs from a sudden force. Students could show the relationship between viscosity and inertia.

19. *Elastic vs. Plastic:* When a material is stressed and becomes permanently deformed it is said to have undergone a *plastic change.* If it can return to its original shape it is said to have undergone an *elastic change.* These concepts of physics have many applications in the human body. For example, a muscle may be very elastic at first but over time and over use it can no longer return to its original shape. Skin becomes less elastic with age and most burn scars create many problems due to the skin's loss of its elastic properties. This is especially bad in children because their skin needs to stretch as they grow. Simple demonstrations of plastic and elastic properties can be done with modeling clay and rubber bands. Springs are good examples because you can stretch a spring with its limits, but beyond that it will not return and becomes permanently deformed.

20. *Hysteresis and Viscoelasticity:* Many fluids in the body show both viscous and elastic properties. They are sort of built in shock absorbers for the body. When a material is stressed under a load it will be deformed as both its elastic and viscous properties come into play. A muscle, like a spring, can be stressed to the point where it will not return to its original shape. The degree to which is does not return to its original shape is called ***hysteresis***. Demonstrations of these physical properties can be done along with those mentioned in *activity 19.* One such activity demonstrating elastic deformation, strain, and hysteresis can be done using rubber bands of different sizes and thicknesses. They will simulate muscles because muscles are stretched when loaded and loose energy to heat so it takes work (energy, i.e. food) to restore them to their original shape. We will be using the concept of strain in this activity. Strain is the ratio of the change in length to the original length. Take a rubber band and measure its original length. Now stretch it, being sure to measure the amount of stretch. Do this a number of times recording your data for each trial. Calculate the strain ratio of the rubber band. Try this with several different rubber bands. The following questions can be answered by the students or used as discussion questions. (1) How is the rubber band similar to a muscle such as in the arm or leg? (2) How do the elastic properties vary over time? (3) As it wears out (i.e. gets older) it may not return to its original shape. How important is this if this were a muscle and what kinds of problems could this loss of muscle tension cause? Springs could also be used in this exercise but rubber bands are cheaper.

21. *Trainer:* Have the sports trainer at your school come in to your class and talk about sports injuries, their causes and their treatments. Out of this you could get some good ideas for discussions of the laws of physics behind these injuires as

well as come up with some ideas for better equipment design, etc. using physics and engineering principles. As a group project you could divide the class up into groups and assign each a specific sports related injury. You could them have them research the present forms of treatment for this type of injury, have them design a piece of equipment that will help prevent this type of injury, or design a device that doctors could use to treat this particular injury more effectively than they do now with current technology.

22. *Center of Gravity:* The following are a couple of activities that not only demonstrate the concept of the center of gravity but also demonstrate differences between boys and girls. When you choose your volunteers be sure to pick boys and girl that are very mature (i.e. footballs players or cheerleaders), the point being that a grown man usually has higher centers of gravity due to upper body development while a grown woman usually has a lower center of gravity. *Activity 1:* Have the student face the wall with their toes touching the baseboard. Have them take two steps back having each foot touch the other as they step back. Now place a chair in front of them. Have them bend over and grab the chair on each side. Have them put their head on the wall and try to pick up the chair without taking their head off the wall, then try to stand up. Boys usually cannot do this because of their high center of gravity. Girls usually can because of their low center gravity. *Activity 2:* of Have a student get down on their knees, place an elbow on their knee and stretch their arm and hand out in front of them as far as possible. Stand an eraser on its end at the tip of their middle finger. Now have the student place their hands behind their back and try to touch the eraser with their nose without falling on their face. Be sure to tell them to catch themselves before their face hits the floor (some actually don't think of this). Boys again usually can't do this and girls can.

23. Load vs. Deformation or (Bone Strength vs. Stiffness): "All biological materials are viscoelastic; i.e., their deformation behavior is time dependent. They are also anisotropic, i.e., their properties are specific to the direction of force application. In the case of bones, this means that the strength of the material depends upon the rate that it is loaded and the dirction of loading.

Strength and stiffness are the important mechanical properties of bone. These properties can best be understood for bone or any other material by examing the material under loading. When a load in a known direction is placed on a structure, the deformation of that structure can be measured and plotted on a load-deformation curve, and the strength and stiffness of the structure can be determined." (5: p180) Fig. 17-1 shows a typical load-deformation curve. You can use many different materials to do this activity. It would be interesting to compare curves of materials such as plastic, wood, metals, etc.

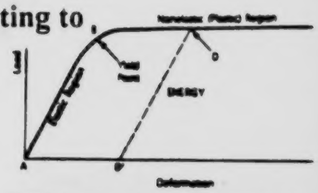
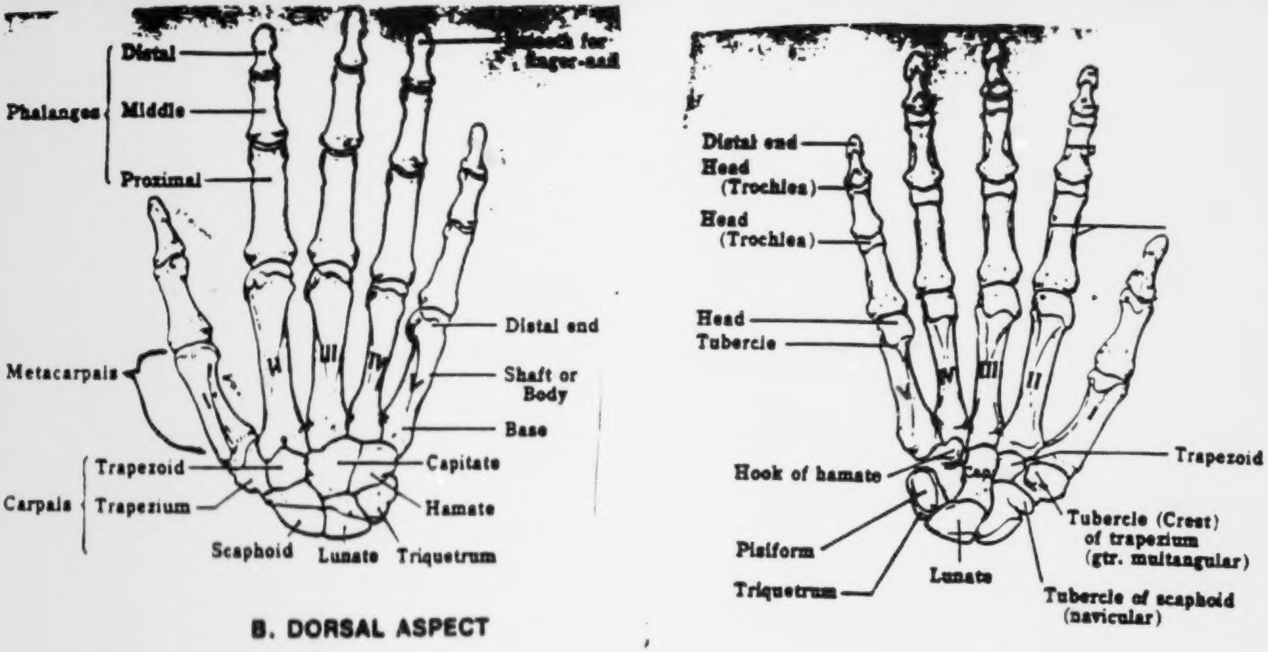


FIGURE 17-1. Load-deformation curve for a somewhat plastic m
The amount of permanent deformation that occurs if the structure
loaded to point D and then unloaded is represented by the distance
between A and D'. B represents the yield point at which deformat


Distal
Phalanges
Middle
Proximal
for finger-nail
Metacarpals
Distal end
Shaft or Body
Base
Carpals
Trapezoid
Trapezium
Capitate
Hamate
Scaphoid
Lunate
Triquetrum
I
II
III
IV
V
Distal end
Head (Trochlea)
Head (Trochlea)
Head
Tubercle
Hook of hamate
Pisiform
Triquetrum
Lunate
Trapezoid
Tubercle (Crest) of trapezium (gtr. multangular)
Tubercle of scaphoid (navicular)

B. DORSAL ASPECT

BONES OF THE HAND

A. PALMAR ASPECT

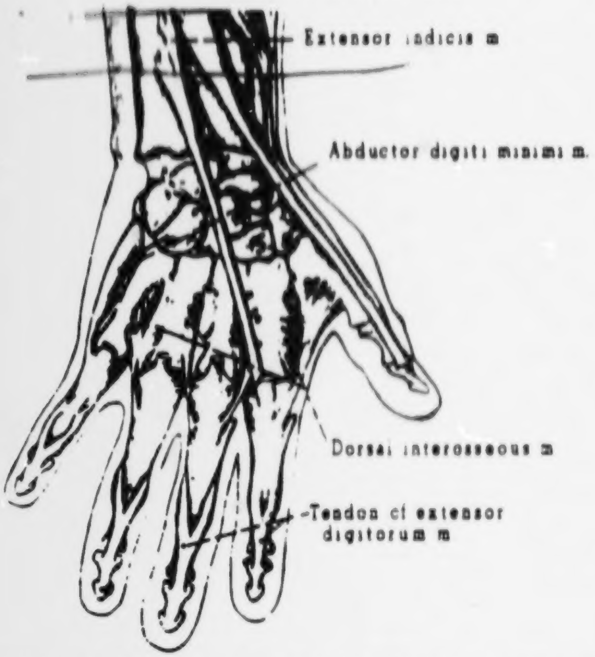

Extensor indicis m
Abductor digiti minimi m.
Dorsal interosseous m
Tendon of extensor digitorum m

Figure 151. Deep layer of muscles of the right forearm and hand, posterior view.

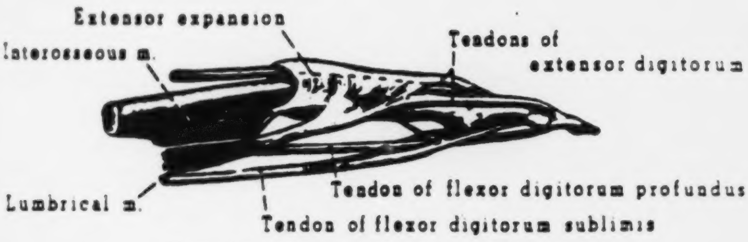

Extensor expansion
Interosseous m.
Tendons of extensor digitorum
Lumbrical m.
Tendon of flexor digitorum profundus
Tendon of flexor digitorum sublimis

Figure 152. Tendons of the finger, lateral view.

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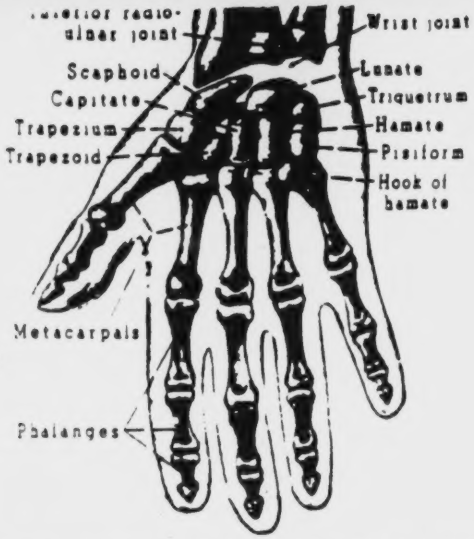
terior radio-
ulnar joint
Scaphoid
Capitate
Trapezium
Trapezoid
Metacarpals
Phalanges
Wrist joint
Lunate
Triquetrum
Hamate
Pisiform
Hook of
hamate

Figure 86. Anterior view of bones of the right forearm and hand.

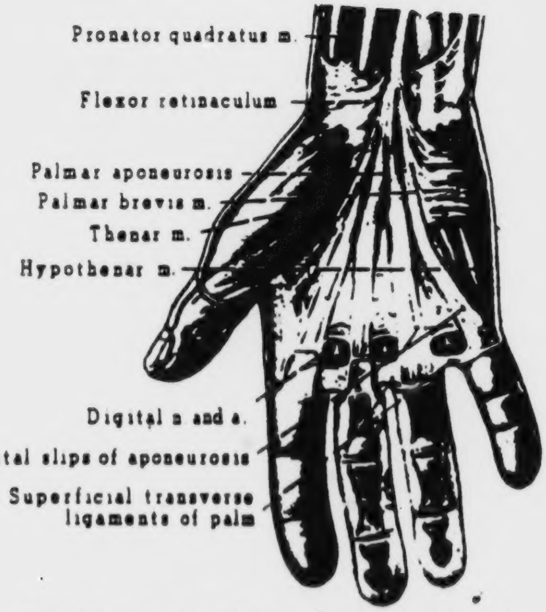
Pronator quadratus m.
Flexor retinaculum
Palmar aponeurosis
Palmar brevis m.
Thenar m.
Hypothenar m.
Digital n and a.
Digital slips of aponeurosis
Superficial transverse
ligaments of palm

Figure 147. Muscles of the palmar aspect of the right hand

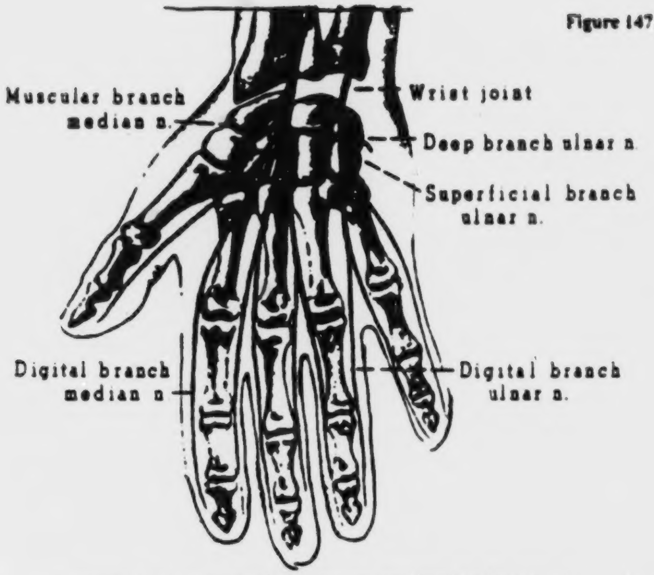
Muscular branch
median n.
Wrist joint
Deep branch ulnar n
Superficial branch
ulnar n.
Digital branch
median n
Digital branch
ulnar n.

Figure 277. Nerves of right forearm and hand (palmar view).

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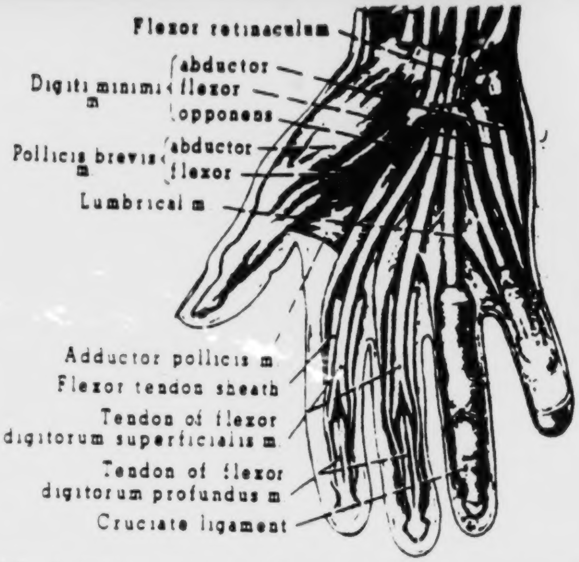

Flexor retinaculum
Digiti minimi m
abductor
flexor
opponens
Pollicis brevis m
abductor
flexor
Lumbrical m
Adductor pollicis m
Flexor tendon sheath
Tendon of flexor digitorum superficialis m
Tendon of flexor digitorum profundus m
Cruciate ligament

Figure 148. Second layer of muscles of the right hand and forearm, palmar aspect.

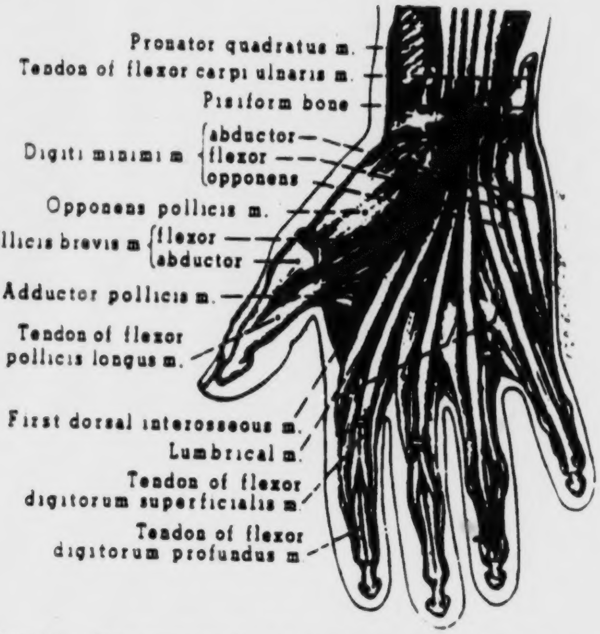

Pronator quadratus m.
Tendon of flexor carpi ulnaris m.
Pisiform bone
Digiti minimi m
abductor
flexor
opponens
Opponens pollicis m.
Pollicis brevis m
flexor
abductor
Adductor pollicis m.
Tendon of flexor pollicis longus m.
First dorsal interosseous m.
Lumbrical m.
Tendon of flexor digitorum superficialis m.
Tendon of flexor digitorum profundus m

Figure 149. Deep muscles of the right forearm and hand, palmar surface.

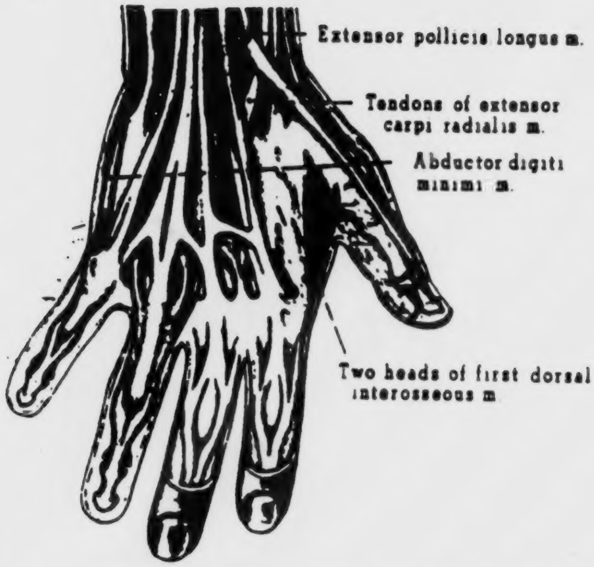

Extensor pollicis longus m.
Tendons of extensor carpi radialis m.
Abductor digiti minimi m.
Two heads of first dorsal interosseous m

Figure 150. Posterior view of the right forearm and hand, showing the superficial muscles

Math Examples in Biomechanics

Science teachers can use biomechanical models as examples for physics problems involving concepts of vectors, geometry, trigonometry, basic algebra, forces, pressure, work, power, angular motion, torque, friction and projectile motion, just to name a few. A few diagrams are included below to show the math and physics applications to biomechanical situations. While it is beyond the scope of this paper to include actual problems, the teacher could take these diagrams and create their own worksheets with problems illustrating the importance of understanding math (and physics) in real life situations. Most of these illustrations are of athletes involved in some type of sports activity. This should make it even more relevant and meaningful to the high school student. Illustrations may be enlarged if necessary and they all came from the the biomechanics text by Ozkaya.

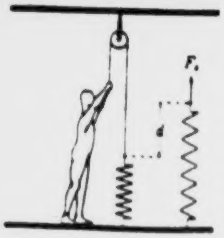


Figure 11.17 *A person stretches the spring by pulling the cable.*

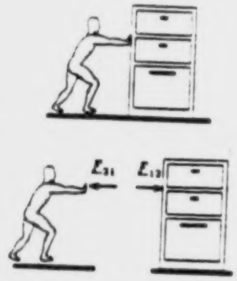


Figure 3.1 *Action and reaction.*

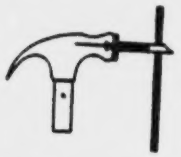


Figure 3.2 *Hammering.*

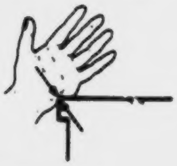


Figure 3.3 *The harder you push, the harder you will be pushed.*

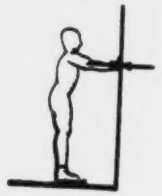
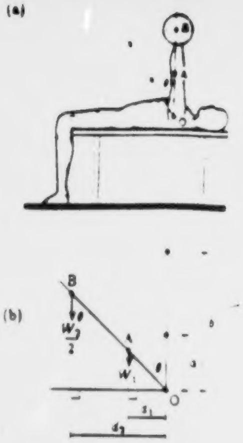
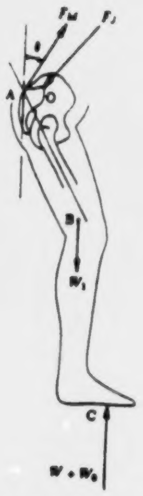


Figure 3.4 *An ice skater.*



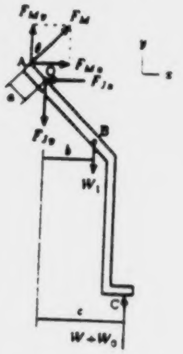
(a)
(b)
B
$\frac{W_2}{2}$
A
W_1
O
d_1
d_2

Figure 4.20 An exercise to strengthen the shoulder muscles, and a simple model of the arm.



F_M
F_J
A
O
B
W_1
C
$W + W_0$

Figure 6.19 *Forces acting on the lower body of the athlete.*



F_{My}
F_M
A
O
F_{Mx}
F_{Jx}
F_{Jy}
B
W_1
y
x
b
c
C
$W + W_0$

Figure 6.20 *Free-body diagram.*

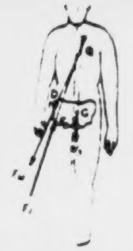
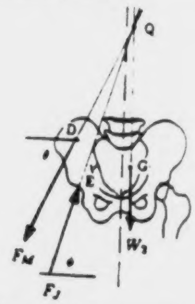
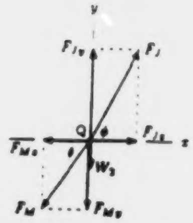


Figure 6.26 *Forces acting on the pelvis during a single-leg (right leg) stance.*



Q
D
E
G
F_M
F_J
W_2

Figure 6.27 *Forces involved form a concurrent system.*



y
F_{Jy}
F_J
Q
F_{Jx}
x
F_{Mx}
W_2
F_M
F_{My}

Figure 6.28 *Resolution of the forces into their components.*

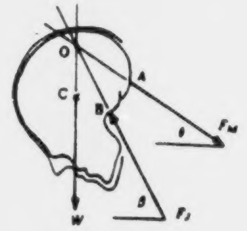
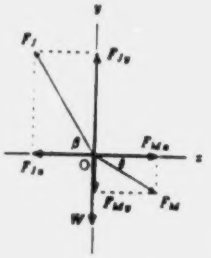


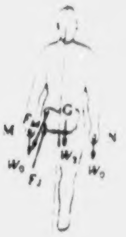
Figure 6.15 *Forces on the skull form a concurrent system.*



y
F_J
F_{Jy}
F_{Mx}
x
F_{Jx}
O
F_{My}
F_M
W

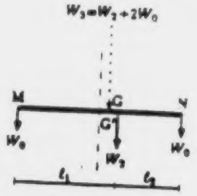
Figure 6.16 Components of the forces acting on the head.

Figure 6.29 Carrying a load in each hand.



G
M
N
W_0
W_2
W_0
F_J

Figure 6.30 *Forces acting on the upper body.*



$W_3 = W_2 + 2W_0$
M
G
N
W_0
W_2
W_0
l_1
l_2

Figure 6.31 *W_3 is the resultant of the three-force system.*

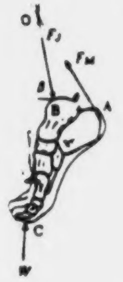
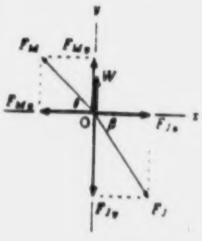


Figure 6.45 *Forces acting on the foot form a concurrent system of forces.*



y
F_M
F_{My}
W
F_{Mx}
x
O
F_{Jx}
F_{Jy}
F_J

Figure 6.46 Components of the forces acting on the foot.

3/3

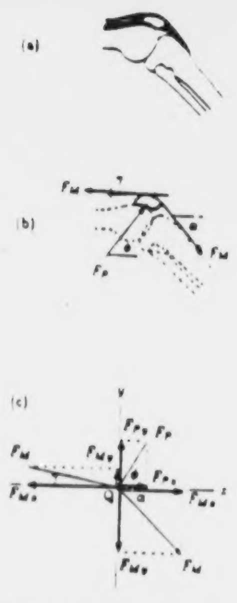

(a)
(b)
F_M
F_P
F_M
(c)
y
F_{Py}
F_P
F_M
F_{My}
F_{Px}
F_{Mx}
F_{Mx}
Q
x
F_{My}
F_M

Figure 6.42 Static analysis of the forces acting on the patella.

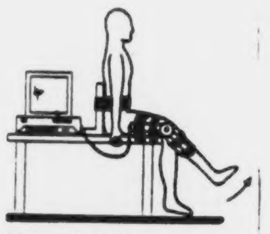
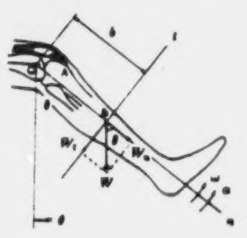


Figure 10.20 Knee extension.


b
x
A
θ
W_1
W_0
W
θ
y

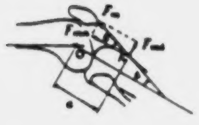


Figure 10.21 Some of the forces acting on the lower leg.

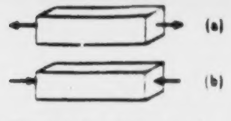


Figure 3.10 (a) tensile and (b) compressive forces.

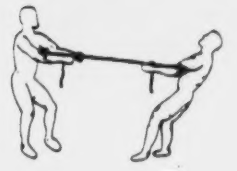


Figure 3.11 Collinear forces.

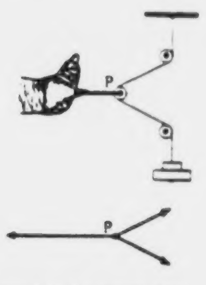


Figure 3.12 Concurrent forces.

Figure 3.13 Parallel forces.

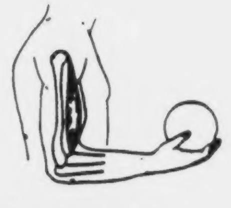


Figure 6.4 Example 6.1.

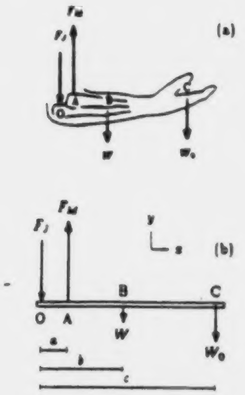

F_M
F_J
(a)
W
W_0
F_M
F_J
y
x
(b)
O
A
B
C
W
W_0
a
b
c

Figure 6.5 Forces acting on the lower arm.

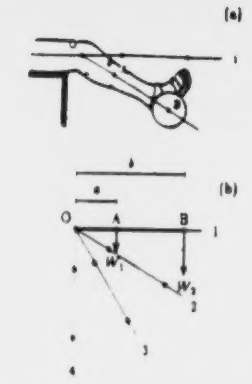

(a)
1
θ
b
a
(b)
O
A
B
1
W_1
W_2
2
3
4

Figure 4.17 Example 4.4

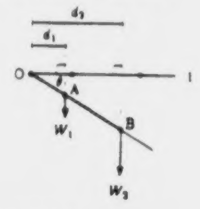

d_2
d_1
O
θ
A
1
W_1
B
W_2

Figure 4.18 Forces and moment arms when the lower leg makes an angle θ with the horizontal.

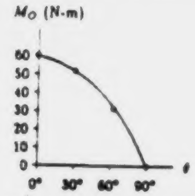


Figure 4.19 Variation of moment with angle θ.

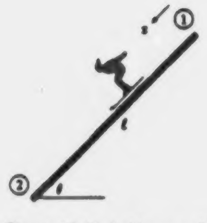


Figure 11.18 A skier on a ski-jumping track.

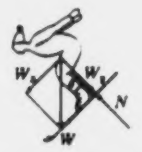


Figure 11.19 Free-body diagram of the ski jumper.

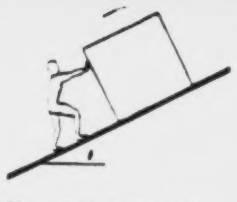


Figure 5.24 Example 5.7

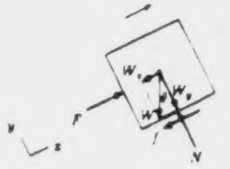

W_x
W_y
W
F
f
N
y
x

Figure 5.25 Free-body diagram of the block.

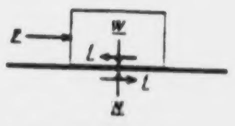


Figure 5.19 Friction occurs on surfaces when one surface slides or tends to slide over the other.

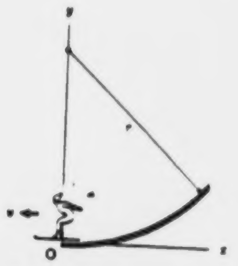


Figure 10.12 Circular arc region of a ski-jump track.

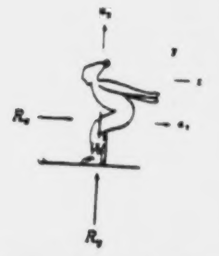

a_y
y
x
R_x
a_x
W
R_y

Figure 10.13 Free-body diagram of the ski jumper before takeoff.

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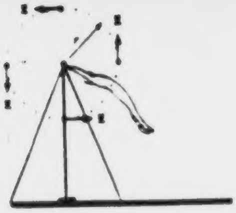

Figure 6.22 *A gymnast doing giant circles.*

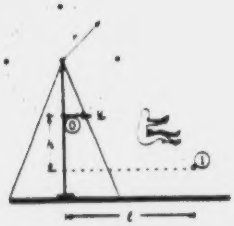

Figure 6.23 *Between 0 and 1, center of gravity of the gymnast undergoes a projectile motion.*

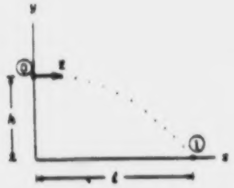

Figure 6.24 *Trajectory of the center of gravity of the gymnast.*

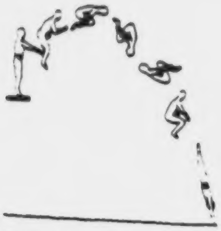

Figure 6.31 *A diver.*

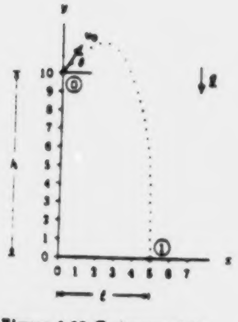

Figure 6.32 *Trajectory of the center of gravity of the diver. (Both x and y are in meters.)*

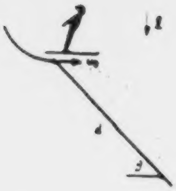

Figure 6.27 *A ski jumper*

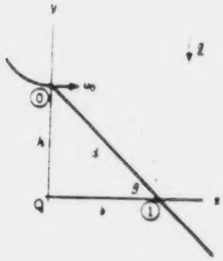

Figure 6.28 *Geometry of the problem.*

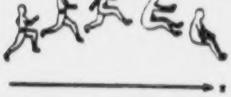

Figure 6.33 *A long-jumper.*

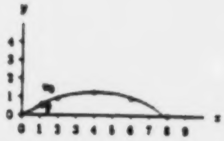

Figure 6.34 *Trajectory of the center of gravity. (Both x and y are in meters.)*

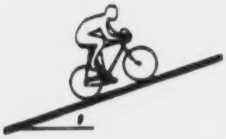

Figure 11.36 *A cyclist.*

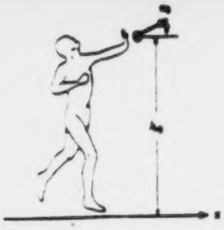

Figure 6.25 *Shot-putter.*

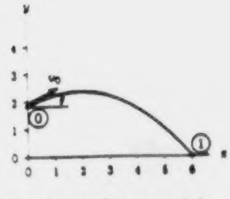

Figure 6.26 *Trajectory of the shot. (x and y are in meters.)*

Figure 6.18 *A ball kicked will undergo a projectile motion.*

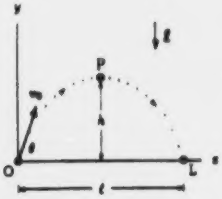

Figure 6.19 *Projectile motion.*

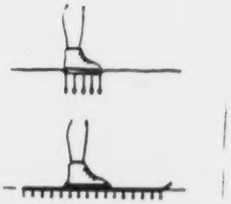

Figure 3.18 *Intensity of force (pressure) applied on the snow by a pair of shoes is higher than that applied by a pair of skis.*

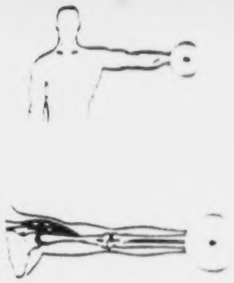

Figure 6.11 *The arm is abducted to horizontal.*

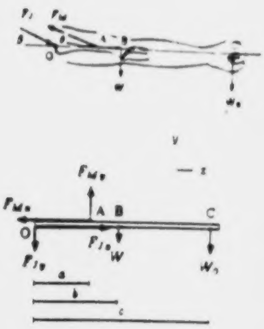

Figure 6.12 *Forces acting on the arm and a mechanical model representing the arm.*

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Research Topics

Have each student choose one of the following topics and either make an oral report or a more in-depth written report. The teacher may want to subdivide some of the topics into more specific ones. Each topic must relate the principles of physics whether the title specifically states it or not. Oral reports should last from 3 to 5 minutes.

Arthritis and other joint problems
The physics of joint mobility
Knee injuries: their causes and repairs
Bone injuries and their repair
Spine injuries and their long term effects
The most common sports injuries and how they are caused
Nerve damage and its physical ramifications on the body
Joints of the body and how they work
Surgical solutions to common injuries
Becoming a doctor and how long does it take
Why a doctor should know something about physic and biomechanics
Bioengineering and related careers
What is biomechanical engineering and what are some careers
Biocompatability of implant materials
Building better prosthesis through physics and engineering
CT (cat) scan
NMR (nuclear magnetic resonance imaging)
Orthopaedics
Carpel tunnel syndrome
Orthoscopic surgery,
Careers in physical therapy
Effects of weightlessness on muscles
Effects of weightlessness on bone growth
Physics of walking
Comparing the muscles of apes to man
Biomechanical explanations for some common birth defects
Comparing the skeleton of apes to man
Physics and the opposable thumb
Computer imaging as related to medical research
Human cadavers vs. computer simulation: the pros and cons
Fluid dynamics and the circulatory system,

Torque and its relationship to human mobility

Improvements in sports equipment over the last 50 years

Give examples of how each of the following physics terms apply to the human body; torque, moment arm, center of gravity, force, friction, elasticity, plasticity, momentum, energy, velocity, inertia and acceleration

Viscosity of liquids with particular emphasis on the human body, Elastic properties of materials with emphasis on the human body

Hysteresis - what is it, some examples with special emphasis on the human body

Bioengineering data and forensic data in the court room

Bibliography

1. Ozkaya, Nihat and Margaret Nordin, *Fundamentals of Biomechanics, Equilibrium, Motion, and Deformation*, Pub. by Van Nostrand Reinhold,115 Fifth Ave., New York, NY 10003

2. Brand, Paul W., *Clinical Mechanics of the Hand* , Pub. by Mosby Year Book, 11830 Westline Industrial Dr., St. Louis, MO 63416

3. Jacob, Stanley W. and Clarice A. Francone, *Structure and Function of Man*, Pub. by W. B. Saunders Co., West Washington Square, Philadelphia, Pa. 1910

4. Time-Life Series: Understanding Computers: *The Human Body*, Pub. by Time-Life Inc., Alexandria, Virginia.

5. Ellison M.D., Arthur L., *Athletic Training and Sports Medicine*, Pub. by The American Academy of Orthopaedic Surgeons, 444 North Michigan Avenue, Suite 500, Chicago, Illinois 60611-3981

TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME: Charlyn R. Kyles

INTERNSHIP: University of Texas Medical Branch at Galveston
Human Biological Chemistry and Genetics
Department

SCHOOL: Contemporary Learning Center
Houston, Texas

PRIMARY SUBJECT: Biology

ACTIVITIES:

- Students will design a science career file
- Students will investigate research equipment
- Apply the scientific method

SUMMARY: These teaching activities are designed to explore science careers in order to develop an appreciation of science research, and explore the use of science procedure and equipment. It is hoped that students' interest in science will be stimulated, laboratory skills enhanced, and appreciation for science research will be enriched.

RESOURCES: Dr. Regino Perez-Polo, Human Biological Chemistry and Genetics, Staff and Departments. University of Texas Medical Branch at Galveston.

Curriculum Implementation Plan - Abstract

Name: Charlyn R. Kyles

Internship: The University of Texas Medical Branch at Galveston, Texas - Human Biological Chemistry and Genetics Department

School: Contemporary Learning Center, Houston, Texas

Primary Subject: Biology

Activities: Students will design a science career file with student entries to be kept in each science room. Students will investigate a research experiment using the scientific method, apply laboratory techniques and learn proper use of equipment.

Summary: These teaching activities are designed to explore science careers in order to develop an appreciation of science research, and explore the use of science procedure and equipment. It is hoped that students' interest in science will be stimulated, laboratory skills enhanced, and an appreciation for science research will be enriched.

Resources: Mentor: Dr. Regino Perez-Polo, Human Biological Chemistry and Genetics, Staff and Departments. Graduate Students.

UTMB-Moody Library

Curriculum Implementation Plan

Goal: Students will use research information to make science career choices.

Objective: Students will investigate science-related careers*

Why?

- Increased demand for advancement
- Personal growth and job satisfaction
- White collar work (lab coat)
- Consistent demand, excitement
- Make a good living; salary, rewarding fringe benefits

Basic Skills Needed:

- Communication skills, talking and writing
- Organizational skills
- Observational skills
- Learning skills

To Do:

- Investigate
- Analyze
- Solve problems; ability to question
- Evaluate; thinking critically

Character Building:

- Good self-image
- Reliable; responsible
- Willing to work hard and steady
- Strong desire to succeed - perseverance
- Resourceful
- Stamina, alert

Education Pre-Requisites:

- High School/G.E.D. (Science, Math, English Emphasis)
- 2 year Associates Degree in areas
- College Degree(s) in some areas

Kinds of Training:

- On-the-job training
- Scientific method/equipment
- Scheduling and planning
- Project execution

* Slide Presentation of the above using Slide Writer

Goal: Students will design a science career file with student entries to be kept in each science room.

ACTIVITIES:

1) SCIENCE CAREER FILE [design - student project]
   - . Master List of Science Category Careers [student project]
     - Industry
     - Medical
     - Health
     - Research
   - . Student Entries
     - Occupational description
     - Job description
     - Importance
     - Employment characteristics
     - Educational programs
       - . Length
       - . Pre-requisites
       - . Curriculum
   - . Student Oral Presentation [follow outline given]
2) Science Career Day [just before the Science Fair]
3) Resources - Materials

   Each classroom will have an area or section named Science Career designed by students.

   Example: "Science Careers Futures are Bright and Green $$$"
4) The Party Activity - Career Game
   - . Available resources
     - 2 - $35.00 - What Color is Your Parachute? by Richard Nelson
     - 2 - $45.00 - Allied Health Education Directory (s) - AMA
     - 2 - $16.95 - Healthcare Career Directory (s)
     - 2 - $10.95 - Science Careers
   - . Encourage Librarian to purchase Science Career information

EXPENSES *

001	Supplies	7 x	=	________
002	Educ. Consultants	7 x	=	________
003	Resources	7 x	=	________

* Funds will be made available from an Exxon Mini-Grant for the 7 teachers in the Science Department at the Contemporary Learning Center in Houston, Texas.

Goal(s): To foster an appreciation for scientific research.
To develop laboratory skills/techniques.
To demonstrate skills in the scientific method.

Objective: Students will investigate a research experiment using the scientific method and apply laboratory techniques and learn proper use of equipment.

SCIENTIFIC PROTOCOL: BCA PROTEIN ASSAY

- BCA Protein Assay for the determination of Protein concentration using a spectrophotometer
  - Instructions on how to prepare
  - Concepts learned
  - Using spectrophotometer
    - scales
    - error bars
    - graphing
    - statistics
    - training
  - Manual skills
    - micropipetting/proper technique
- Scientific Method
  - Hypothesis
    - specific aim
    - background research
  - Experiment - Test
  - Results
    - data-validation
  - Conclusion discussion
    - evaluation
    - future plans
- Subject - Course - Integration

  Mathematics
  - Metric conversions
  - Graphing
  - Statistics
  - Scale Conversion

  Chemistry
  - Preparation of reagents
  - Solutions
  - Mixtures

  Reading Comprehension
  - Following instructions
  - Directions

Scientific Protocol: BCA Protein Assay

Hypothesis: The parameters of the standard curve are used to calculate the protein concentration of unknown samples.

Specific Aim: To determine protein concentration of unknown protein samples against known protein standards, utilizing test tubes and a computerized spectrophotometer.

Background Research:

The earliest methods for protein assays utilized "specific" precipitants for each of the amino acids in a protein hydrolysate. Such assays required gram quantities of protein and were not readily reproducible from laboratory to laboratory. Furthermore, they were not sufficiently specific, and reagents were not available for all the amino acids. In 1950, microbiological assays for amino acids were introduced. Certain bacteria could be grown in media with one of the amino acids missing and all the others in excess, so that, on addition of a protein hydrolysate, the organism grew in proportional to the concentration of that amino acid. It was not until Stein and Moore (1983) introduced the Ninhydrin amino acid analyzer and helped introduce commercial automated analysis that protein assays attained the sensitivity and precision required for chemical analysis.

Current micromethods for protein assays are not only more sensitive, but far more rapid compared with methods of only ten years ago. In fact, the rate-limiting factor in most isolations is no longer the chemical methodology, but the procedure required to monitor the biological properties of a protein. Referring to advances in protein assays, Stein in Fundamentals of Protein Biotechnology said, "Things have changed (and improved) over the years. The only thing that remains constant and an absolute requisite for all these procedures is a truly specific and reliable bioassay and people to do it right."

The Pierce BCA Protein Assay Reagent is a highly sensitive reagent for the spectrophotometric determination of protein concentration. Protein concentration is calculated from a calibration curve prepared from up to thirty standards of known concentrations. The calibration curve is computed as a least-squares fit to a straight line if three or more standards are used. Statistical calculations are performed on the standard data to identify standards which fit the calibration curve poorly. Unacceptable standards can be rerun or deleted and new standards can be added. Each time the calibration curve coefficients are re-calculated. When the curve fit is satisfactory, the coefficients are stored and unknown samples can be run.

Experiment - BCA Assay Protocol

1. Prepare a set of protein standards of known concentration by diluting a stock solution of BSA (bovine serum albumin) or other suitable protein, in the same diluent as the unknown samples. The set of protein standards will cover the range of concentrations suitable for the assay protocol one is following.

2. Pipet 0.1 ml. of each standard or unknown protein sample into the appropriately labelled test tube. For blanks, use 0.1 ul. of diluent.

3. Add 2.0 ml. Working Reagent to each tube. Mix well.

4. Incubate all tubes at the selected temperature and time.

5. After incubation, cool all tubes to room temperature.

6. Using the spectrophotometer, measure the absorbance at 562 nm. of each tube versus water reference.

7. Use the computer to show and calculate the protein concentration of each sample from the plot of a standard curve.

8. The computer will prepare a standard curve by plotting the net (blank corrected) absorbance at 562 nm. versus protein concentration. This standard curve will be used to determine the protein concentration for each unknown protein sample. Standard curve is used to calculate the concentration of unknown samples.

Results

Data Validation: Bicinchoninic acid in the form of its water-soluble sodium salt is a sensitive, stable and highly specific reagent for the cuprous ion. BCA Protein Assay Reagent combines the well-known biuret reaction (protein reacting with Cu^{2+} in an alkaline medium to produce Cu^{1+}) with the unique features of BCA. The dilutions from the lowest to the highest produced a light purple in a range to a dark purple product after incubation at 37°C for 30 minutes. The product is water soluble and exhibits a strong absorbance. This allows the spectrophotometric quantitation of protein in aqueous solutions. The graphs indicate known standards and within its parameters unknown samples were calculated. The standard curve was used to calculate the concentration of unknown samples. To aid in the evaluation of the reliability of the calculated standard curve, statistical information was provided. To aid in the analysis of the data, the plotted standard curve was displayed. The parameters were displayed with the curve, along with the regression coefficient. The parameters of the standard curve was used to calculate the concentration of the unknown samples. The coefficient of variation shows the precision of the sample data. Lack of precise data is usually a result of sample preparation. This happened twice in two previous assays and a dilution correction was made.

Conclusion

Discussion: BCA Protein Assay Reagent determines protein concentration by conventional benchtop procedures utilizing test tubes and a computerized spectrophotometer. BCA is a highly sensitive reagent for the spectrophotometric determination of protein concentration. Protein concentrations of samples were measured with the bicinchoninic acid reagent using bovine serum albumin as the standard. Data was expressed as mg/ml. The set of protein standards covered the range of concentrations suitable for the assay protocol followed. The solutions of the protein standard and the samples were measured with a spectrophotometer at 562 nm. The blank was measured first. Then the standard dilutions were measured along with the blank measured again. The unknown samples were placed into the cuvette and read. The computer prepared the standard curve, and the protein concentration for each unknown protein sample were read within the parameters of the standard curve, as shown on the graphs.

The graduate students used the same BCA protocol in their research to determine protein concentration in different cell lines. Donald and Jouan used rat brain tissue; Lee Chi-PC 12 rat cells; Leslie-Astrocyte cells surrounding the neuron in rat cells. The amount of protein must be known initially before they could proceed further in their experiments.

It was noted in George R. Jackson's, et al. research paper on Nerve growth factor effects on pyridine nucleotides after oxidant injury of rat pheochromocytoma cells that one of the viability assays was BCA. Protein concentrations of PC 12 samples were measured with the bicinchoninic acid reagent, using bovine serum albumin as the standard. Data was expressed as CPM/mg. protein.

Evaluation

The graphs indicate that the parameters of the standard curve can be used to calculate the protein concentration of unknown samples, using the spectophotometer. The Pierce BCA* Protein Assay Reagent offers the researcher assay procedures for the spectrophotometric determination of protein concentration. The set of protein standards used covered the range of concentrations suitable for the assay protocol.

Future Research

The activation of nuclear poly (ADP-ribose) polymerase (PADPRP) following DNA damage results in rapid depletion of NAD^+. Inhibition of poly (ADR-ribose) polymerase also enhanced viability following H_2O_2 injury. (George R. Jackson, et al. Nerve growth factor effects on pyridine nucleotides after oxidant injury of rat pheochromocytoma cells). The concentration of the enzyme that resulted in the injury should be known.

In the future, I hope to learn and use an enzyme assay to determine enzyme concentration using a spectophotometer.

```
Samples   DispStdCurve   ViewStats   Method   SaveClear   Print   Quit
------------------------------------------------------------------------
Assay type: Bradford                        Analytical wl: 562.0 nm
Standards file: A:\WORK_STD                 Method name: A:\BCA
Component name: new_stuff                   Units: ug/ml
Curve fit: Linear
Sampling device: None
Number of standards: 5                      Number of replicates: 2
Read average time: 0.50 sec                 Flag standards over: 1.000 %

                Std      Calc                        Analytical
Std#   Rep#     Conc     Conc       Diff      %CV    abs          Use  Flag

Read 1  1       25.000   51.7410    26.7410          0.0646       [N]
Read 1  2       25.000   51.6192    26.6192          0.0645       [N]
      Avg:

Read 2  1       50.000   51.7101    1.7101           0.0646       [Y]
Read 2  2       50.000   44.8605    -5.1395          0.0562       [Y]
      Avg:               48.2853    -1.7147          0.0604       [Y]

Read 3  1       100.00   103.2333   3.2333           0.1274       [Y]
Read 3  2       100.00   94.3955    -5.6045          0.1166       [Y]
      Avg:               98.8144    -1.1856          0.1220       [Y]

Read 4  1       150.00   147.8452   -2.1548          0.1818       [Y]
Read 4  2       150.00   156.0819   6.0819           0.1919       [Y]
      Avg:               151.9635   1.9635           0.1869       [Y]

Read 5  1       200.00   219.3148   19.3148          0.2690       [Y]
Read 5  2       200.00   193.6619   -6.3381          0.2377       [Y]
      Ave:               206.4883   6.4883           0.2534       [Y]

Read 6  1       250.00   245.5232   -4.4768          0.3010       [Y]
Read 6  2       250.00   243.3736   -6.6264          0.2984       [Y]
      Avg:               244.4484   -5.5516          0.2997       [Y]

Read 7  1       400.00   242.7402   -157.2598        0.2976       [N]
Read 7  2       400.00   243.1833   -156.8167        0.2981       [N]
      Avg:

Read 8  1       600.00   243.0198   -356.9802        0.2979       [N]
Read 8  2       600.00   244.0668   -355.9332        0.2992       [N]
      Avg:

Read 9  1
Read 9  2
```

```
ReadSamples   Standards   SaveClear   Print                          Quit
------------------------------------------------------------------------
Results file: A:\WORK_RES                   Standards file: A:\WORK_STD
Assay type: Bradford                        Analytical wl: 562.0 nm
Component name: new_stuff                   Method name: A:\BCA
Curve fit: LIN Slope: 0.0012 A-int: 0.0015  Number of sample replicates: 2
Dilution correction: [Yes]                  Flag samples over: 1.000 % CV
Read average time: 0.50 sec                 Sampling device:  None

Sample           Analytical                 Dilution     Conc
  ID     Rep#    abs                        Factor       ug/ml      %  Flag

1        1       0.3243                     1.0000       264.6495
1        2       0.2881                     1.0000       234.9423
                                              Mean:      249.7959

2        1       0.1710                     1.0000       138.9754
2        2       0.1623                     1.0000       131.8139
                                              Mean:      135.3946

3        1                                  1.0000
```

335

329

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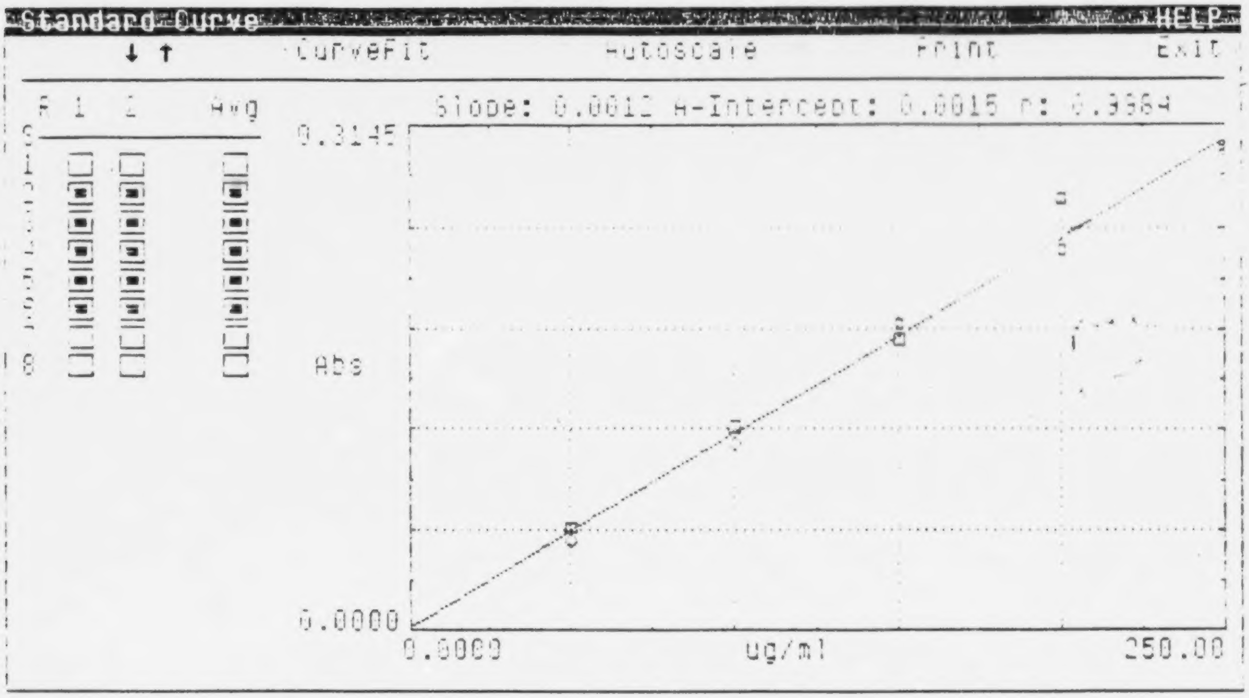
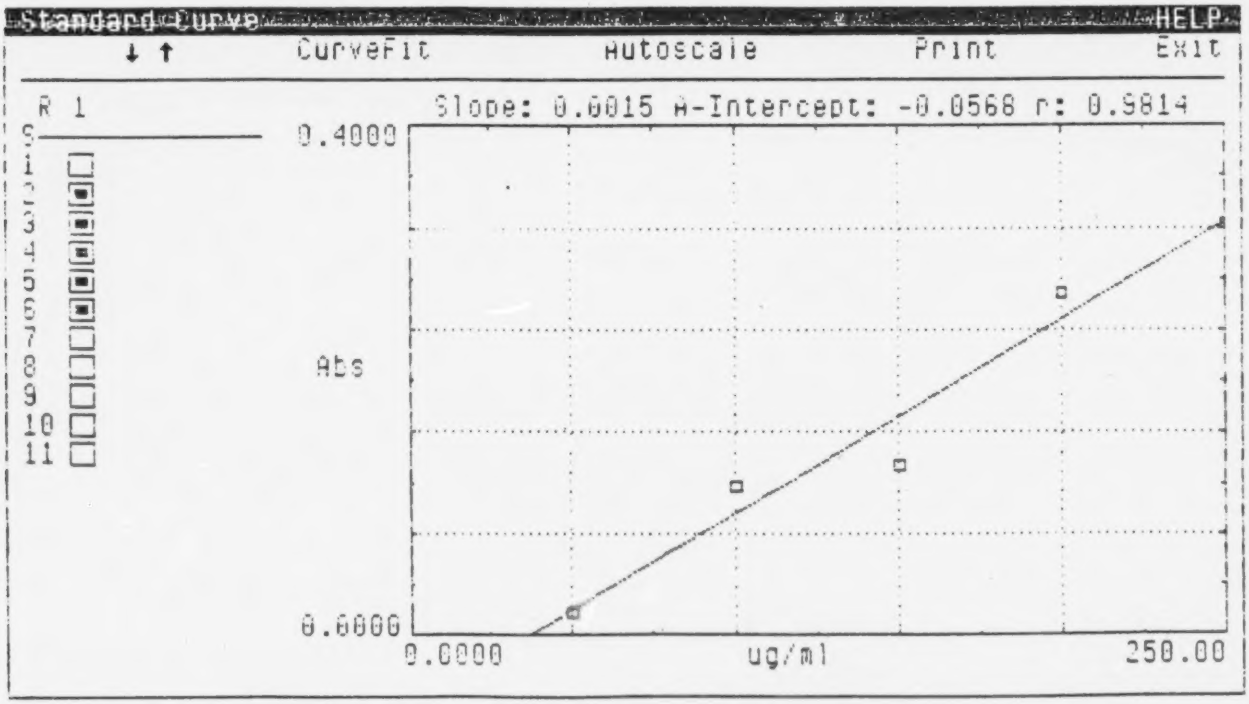

Standard Curve
HELP
↓ ↑
CurveFit
Autoscale
Print
Exit
0.3145
Abs
0.0000
0.0000
ug/ml
250.00

Slope: 0.0012 A-Intercept: 0.0015 r: 0.9984

S	R 1	2	Avg
1	☐	☐	☐
2	☒	☒	☒
3	☒	☒	☒
4	☒	☒	☒
5	☒	☒	☒
6	☒	☒	☒
7	☐	☐	☐
8	☐	☐	☐


Standard Curve
HELP
↓ ↑
CurveFit
Autoscale
Print
Exit
0.4000
Abs
0.0000
0.0000
ug/ml
250.00

Slope: 0.0015 A-Intercept: -0.0568 r: 0.9814

S	R 1
1	☐
2	☒
3	☒
4	☒
5	☒
6	☒
7	☐
8	☐
9	☐
10	☐
11	☐

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Summer Research Program for High School Students

STEPS IN PREPARING FOR AN ORAL PRESENTATION

1. Determine audience and gather information about participants
    - What are their current needs/interests in the topic?
    - How many will attend session?
    - What is their training, age, type of practice, sex, etc.?
2. Set objectives for what you want the audience to learn or do.
3. Design presentation to accomplish objectives.
    - Every presentation has:
        1. Beginning (introduction - goals/objectives of presentation)
        2. Middle (main content)
        3. End (summary, conclusions)
    - Plan timing.
    - Define content (what you want to do).
    - Consider process (how you want to do it).
        1. Presentation method (lecture, small groups, etc.)
        2. Visual aids (slides, charts)
        3. Handouts
4. Make notes to present from.
    - Get familiar enough with material so you do not worry about content.
    - Keep you from reading.
5. Rehearse.
    - Check timing.
    - Get comfortable with content and format.
    - Get familiar with using microphones, visuals, etc.
    - Get feedback.
6. Arrange room where you will present.

DO'S AND DONT'S OF PRESENTING

DO

Read your audience continually.

Give audience a chance to catch up.

Be enthusiastic.

Speak loudly and clearly.

Make eye contact with audience

Be alert for your distracting mannerisms.

Move around.

Talk in a conversational tone.

Use gestures.

Relax.

Eliminate all possible problems beforehand.

Expect problems to occur.

Stick to your planned timetable.

Summarize main points.

DON'T

Stand in front of your visual aid.

Mumble.

Use language that will make others uncomfortable.

Apologize.

Stand absolutely still

Talk to floor, ceiling, or part of audience.

STEPS IN PRESENTING

1 - Re-rehearse

2 - Develop a checklist

3 - Assemble visuals, handouts, notes, etc.

4 - Check room setup

5 - Think through first five minutes of presentation

6 - Turn your attention and energy to audience

GUIDELINES FOR PREPARING VISUAL AIDS

DO:

- USE the simplest picture.
- USE the fewest words.
- USE color.
- USE the biggest type for most important ideas.
- CENTER material.
- GET professional help in designing slides.
- OUTLINE key information you wish to transmit
- RE-WORK data from scientific literature so listeners can easily digest information that is seen for only a moment. (e.g. if the original gives numbers and percent, perhaps percent alone is all that's needed on slide.)
- USE progressively smaller print or some other means to give weight to the relative importance of treatments or prognoses.

DON'T:

- PUT too much on one slide.
- PROJECT a complicated diagram.
- PUT too much data on one slide.

  (These are often too complex and virtually impossible to explain)
- PROJECT whole paragraphs of text.
- HAVE a list of questions only.
- PRESENT slide with graphic material without explanation of how it's been prepared for presentation.
- USE the laundry list approach.

PURPOSES OF VISUAL AIDS

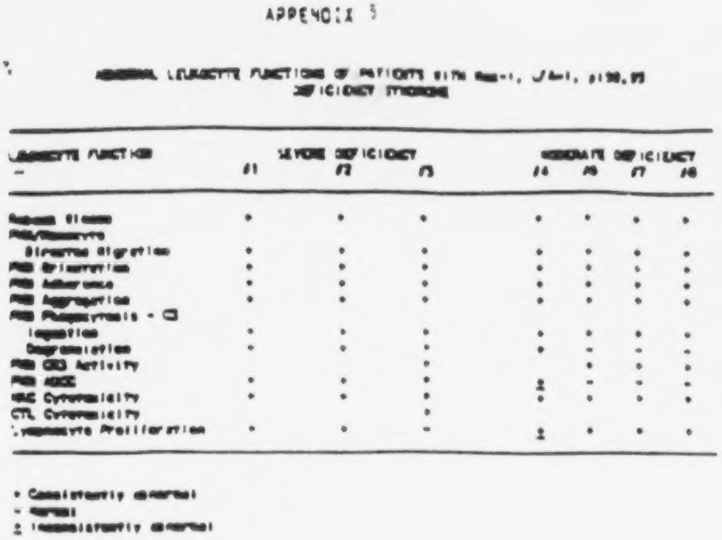
Reinforce your message with:
- picture
- graph
- key word
- key phrase
- summary

Add to your message with:
- emphasis
- humor
- drama

Serve as a prompt.

EXAMPLE - BAD/GOOD SLIDES

BAD SLIDE ----->


APPENDIX 5

The purpose of the Tables in the above slide is to show the leukocytes with LFA-1 etc. deficiency have defects in adherence dependent functions. To transmit this information in a slide, the slide below is all that is necessary.

GOOD SLIDE ----->

LEUKOCYTE FUNCTION	SEVERE	MODERATE
Adherence independent	-	-
Adherence dependent	+	±

- Normal
± Inconsistently abnormal
+ Consistently abnormal

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COMPARISON OF THREE VISUAL AIDS

FLIP CHARTS	SLIDES	TRANSPARENCIES
Can keep pages visible	Cannot keep visible	Cannot keep visible
Intimate	Cold	Lukewarm
Useful for small group	Only for large group	Middle-sized group (30 - 100)
Room is lighted	Room is dark	Room is lighted
Can alter	Cannot change	Can change
Easy to skip one	Hard to skip one	Easy to skip one
Bulky to carry	Easy to carry	Easy to carry
Need nothing else	Need projector	Need projector
Little limit of movement	Limits movement	Some limits on movement
Can face audience	Can face audience	Face audience

6

PURPOSES OF HANDOUTS

- Reinforces your message
- Supplements your message
- Enhances audience learning
- Facilitates audience participation
- Provides legible messages not in visuals
- Replaces visuals
- Provides transition for action

GUIDELINES FOR USING HANDOUTS

- For note taking, hand out before
- For later reading, hand out after
- Talk through handouts
- Supporting arrangements for use

MOVEMENT IN FRONT OF AN AUDIENCE

- Be natural.
- Use hand gestures.
- Walk.
- Use open postures.
- Move through audience.

READING YOUR AUDIENCE

- Nonverbal signs.
- Look for their eyes.
- Audience movement.
- Is anyone asking questions?
- Is anyone taking notes?

e

DEALING WITH NERVOUSNESS

- Expect to be nervous
- Be suspicious if you are not
- Plan and prepare
- Rehearse
- Meet your audience before you speak
- Think about appearing relaxed and confident
- Have 2-3 quiet minutes before you speak
- If necessary, memorize the first sentence
- Make eye contact immediately

EFFECTIVE OPENINGS

- Establish your competence

  Build your confidence

  Set tone for presentation

  Engage audience

- Appropriate to occasion and audience
- Positive, confident
- Make immediate eye contact with audience
- Acknowledge your introduction
- Get down to business
- State rationale for choosing topic, why it's relevant and what they expect to achieve (objectives) through presentation. (A slide listing two or three goals of presentation is useful here.) Remember goals are different than objectives. Think of them as "umbrella areas" for specific objectives. State goals clearly and succinctly.
- Use case presentation to elicit audience attention and interest. (photos and abstract of essential history are helpful.)
- Decide on opening as last step in preparing

EFFECTIVE CLOSINGS

- End on time!
- Summarize

  (A 1-slide summary of why, when, how and what helps make the major message stand out and be remembered.)
- Conclusions
- Questions
  (Always restate the question to assure you're answering the question and so that all people in the audience will hear the question and answer.)
- .Thank the audience

SUMMARIZING

- Repeat key words.
- Repeat key concepts.
- Refer to objectives.
- Ask questions.
- Show linkages among concepts.
- Use summary visual aids.

OTHER TIPS

- Have a helper at back of room.
- Linger around after the presentation.
- Legitimize questions from the audience early in the presentation. Say, e.g., "That's an important point. I'm glad you brought that up." This will reinforce audience participation.
- Follow-up with individuals after the session.
- Space both the presentation and the audience participation.

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Summer Research Program for High School Students. *Steps in preparing for an oral presentation.*

TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME: Johnetta Session

INTERNSHIP: UTMB-Galveston

SCHOOL: Ball High School
Galveston, Texas

PRIMARY SUBJECT: Physical Science

ACTIVITIES:

- Keep a daily journal of all observations
- Visit UTMB research laboratories
- Photograph and identify specific scientific instruments used in research labs
- Devise a list of questions to interview personnel
- Write a 5 page research paper
- Present an Oral report
- Explore career opportunities

SUMMARY: This CIP is designed to allow students practice in oral communication, to make students aware of various science careesr, to allow students to work in teams, and to provide practice in writing. After completing these activities, the student will have enhanced his/her self-confidence, have participated in cooperative learning, will have become aware of resources available at UTMB, and I hope, students will view the study of science as exciting and fun.

RESOURCES: See attached

TTIP

Curriculum Implementation Plan

Abstract

Name: Johnetta Session

Internship: University of Texas Medical Branch, Galveston, Texas
Human Biological Chemistry & Genetics Department Research Laboratory

School: Ball High School

Primary Subject: Physical Science

Student Activities:

1. keep a daily log journal of all observations, impressions, and activities related to physical science class for a minimun of one semester
2. visit UTMB research laboratories
3. photograph and identify specific scientific instruments used in research labs
4. devise a list of questions to interview UTMB personnel
5. visit a UTMB lab to identify safety policies and procedures
6. visit a UTMB lab and identify chemical compounds used in research and explain their importance to the research project being investigated
7. write a 5 page research paper on a science topic
8. orally explain to classmates how to operate one specific scientific instrument used in laboratory visited
9. locate UTMB job openings bulletin boards to explore career positions available
10. choose 3 job careers and research the demand, salary, and specific duties involved

Summary

This curriculum plan is designed to allow students practice in oral communication, to make students aware of various science careers, to allow students to work in teams, and to provide practice in writing. After completing these activities, the student will have enhanced his/her self-confidence, have participated in cooperative learning, will have become aware of resources available at UTMB, and I hope, students will view the study of science as exciting and fun.

Resource Consultants

1. Dr. E. Brad Thompson, Chairman
   Human Biological Chemistry & Genetics Department
   University of Texas Medical Branch
   Galveston, Texas 77555
2. Mrs. Betty Johnson, UTMB
   Dept. of HBC&G
3. Dr. Clifford W. Houston, UTMB
   Office of Multicultural Affairs
4. Mrs. Marsha Ricks, UTMB
   Office of Multicultural Affairs
5. Dr. Ghulam Ansari, UTMB
   Dept. of HBC&G
6. Dr. Jon I. Teng, UTMB
   Dept. of HBC&G

7. Dr. Steven Widen, UTMB
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9. Dr. Wayne Bolen, UTMB
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15. Dr. Marion Dodson, UTMB
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16. Dr. David McAdoo, UTMB
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17. Dr. Jack Alperin, UTMB
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27. Mrs. Rhoda Thompson, UTMB
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28. Phyllis Jendrusch, UTMB
    School of Allied Health Sciences

29. Renee Dollar, UTMB

School of Allied Health Sciences

30. Elizabeth Klillingsworth, UTMB

Reference Library

31. Mr. Richard Toledo, Superintendent

Galveston Independent School District

Galveston, Texas 77550

32. Mrs. Barbara McIlveen, GISD

Assistant Superintendent for Administrati

33. Jodie Wisrodt, GISD

Administrator

34. Mr. Carlton Tucker, GISD

High School Principal

35. Jeanne Wells, GISD

Administrator

36. Mrs. Barbara Cain, GISD

High School Science Chairman

37. Mrs. Benny Jeffries, GISD

Communities in Schools Director

38. Mrs. R. Mickey Ohlendorf, GISD

Administrator

39. Mr. Jack Stork, GISD

Middle School Principal

40. Mrs. Joycelene Demerson, GISD

Middle School Science Chairman

41. Mrs. E. J. Garcia, GISD

Elementary Principal

42. Mrs. Brenda May, GISD

Elementary Principal

43. Mrs. Terri Watkins, GISD

Elementary Principal

44. Mrs. Alice Diag, GISD

Elementary Principal

45. Mr. Bill Heuman, GISD

Elementary Principal

46. Mrs. Nancy Bright, GISD

Administrator

47. Mr. Brian Walenta, Director

Texas Teacher Internship Program

Texas A & M University

College Station, Texas 77843

48. Lisa Gabriel, UTMB

School of Allied Health Sciences

49. Dr. David Rassin, UTMB

Dept. of HBC&G

50. Dr. Harold Sandstead, UTMB

Dept. of HBC&G

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Summary

While working for Dr. E. Brad Thompson, I investigated the feasibility of establishing a mentoring program for teachers and students of GISD with HBC&G staff and graduate students. Using the UTMB library, I researched the topic mentoring. Many articles were related to student mentoring programs, but I did not find any articles on teachers being mentored by a medical facility staff.

After contacting several administrative and management staff in the GISD school system, I invited them to a brainstorming panel discussion on mentoring. Eleven people participated in the panel discussion, which provided insight into established mentoring programs between the school district and UTMB. The meeting allowed GISD staff to become acquainted with Dr. Thompson and to hear his ideas and plans for the creation of an effective, long term association between HBC&G and Galveston public schools. I taped the panel discussion, wrote a summary, and sent a letter of appreciation to all panel participants.

I devised a mentoring questionaire for the eighty-one members of the HBC&G staff and elementary principals of GISD. After visiting five elementary principals, I sent a memorandum to the elementary summer school teachers and asked that they mail their comments to me.

Dr. Susan Knock, a physiology instructor in the School of Allied Health Sciences, shared with me her experiences mentoring students. She suggested that I contact the SAHS director of student affairs, SAHS counselors, and the SAHS director of community relations. These people could possibly assist me in obtaining SAHS students to visit my classroom, mentors for teachers, and resource persons for teachers and students.

Dr. Clifford Houston, and Marsha Ricks, UTMB Office of Multicultural Affairs, met with Dr. Thompson and me to discuss ways they could support us in mentoring teachers and students. They suggested sources of financial support for a teacher mentoring program. Phyllis Jendrusch, UTMB SAHS, sent copies of my mentoring questionaire to Rachael Acquilar, President of the Multicultural Awareness Council, and Kim Bachmeier, President of the SAHS Student Organization, with the purpose of recruiting SAHS students to visit my physical science classes in the fall. The public relations department of UTMB provided me information on tours available to elementary, middle, and high school students. Lisa Gabriel, an SAHS counselor, said she would provide me with a list of students willing to visit my physical science classes this fall. This intern experience has been very rewarding. Participating in teamwork and problem solving was frequent and I am more aware of science careers. My speaking and writing skills have been enhanced.

EVALUATION

At the end of the school year, UTMB scientists and graduate students and the physical science students will receive a questionaire to determine the effectiveness of the interactions and the success of the lesson plan objectives.

CIP

Objectives:

1. To allow students practice in oral communication
2. To allow students to work in teams
3. To allow students practice in writing
4. To allow students to research available science careers
5. To allow students to relate physical science concepts to UTMB research labs

Activities:

1. Students will keep a daily log journal of all observations, impressions, and activities related to physical science class for a minimun of one semester. Objectives 3 and 5

2. Students will individually visit a UTMB research laboratory. The student will photograph and identify specific scientific instruments. The student will identify safety precedures and policies. The student will orally explain to the class the operation of one specific scientific instrument in the laboratory visited. Objectives 1 and 5

3. A pair of students will visit a UTMB research laboratory. The students will interview the scientists about their research project. The students will identify the chemical compounds used by the scientists. The students will orally explain to their classmates the importance of these chemicals in the study of that research project. Objectives 1, 2, and 5

4. After visiting a UTMB research laboratory, students will individually choose a science topic related to the research being conducted in the laboratory. The student will then write

a 5 page research paper. Objective 3

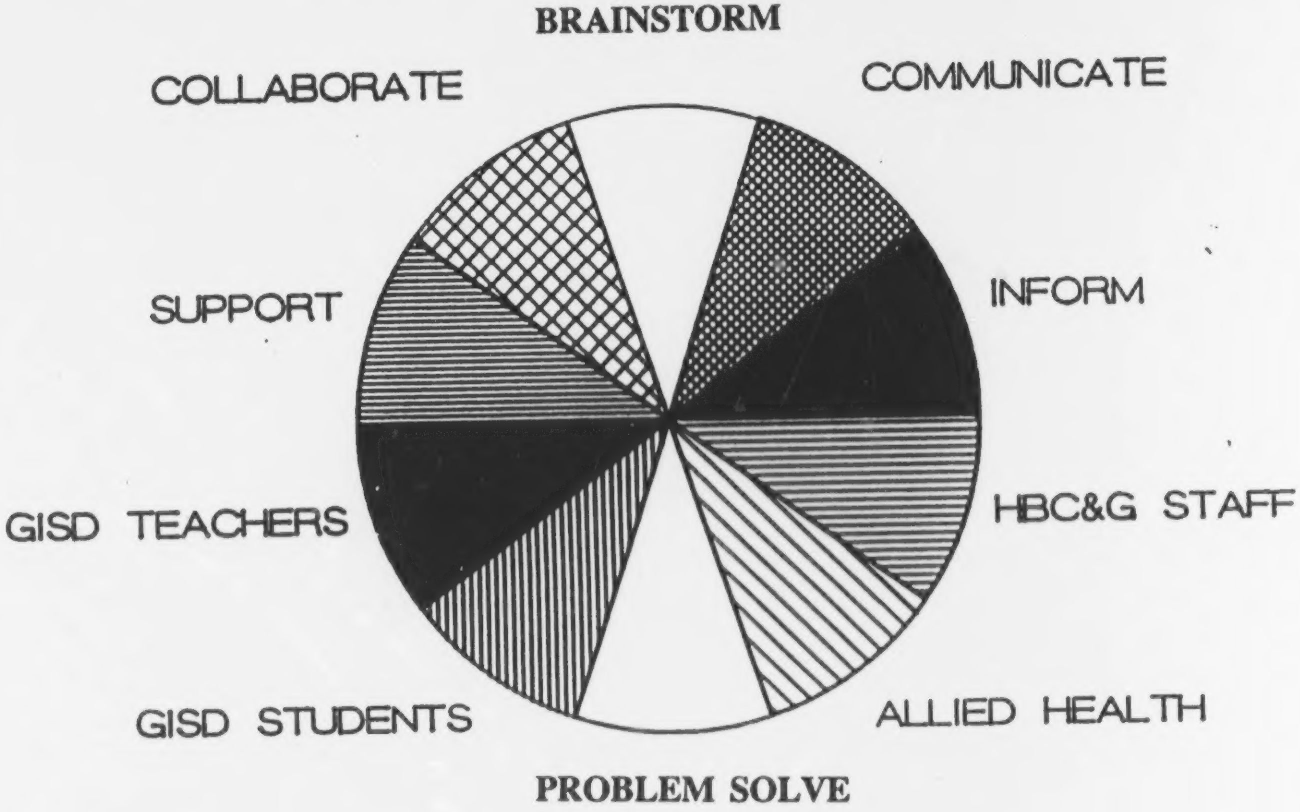
5. A group of 3 students will locate the bulletin boards at UTMB listing job positions available. Each student will list 8 positions including the titles and qualifications. The students will check their listed positions to verify there are no duplicates. The group of students will then create a directory of 24 possible science careers. Objectives 1, 2, 3, and 4

6. Students will individually choose 3 science careers and research the demand for, salary, and specific duties involved. Objectives 3, 4, and 5

7. Students will shadow a scientist for a day. The student will list all observations and impressions. The student will identify the parts of the scientific method he/she observed while present in the lab. Objectives 3 and 5

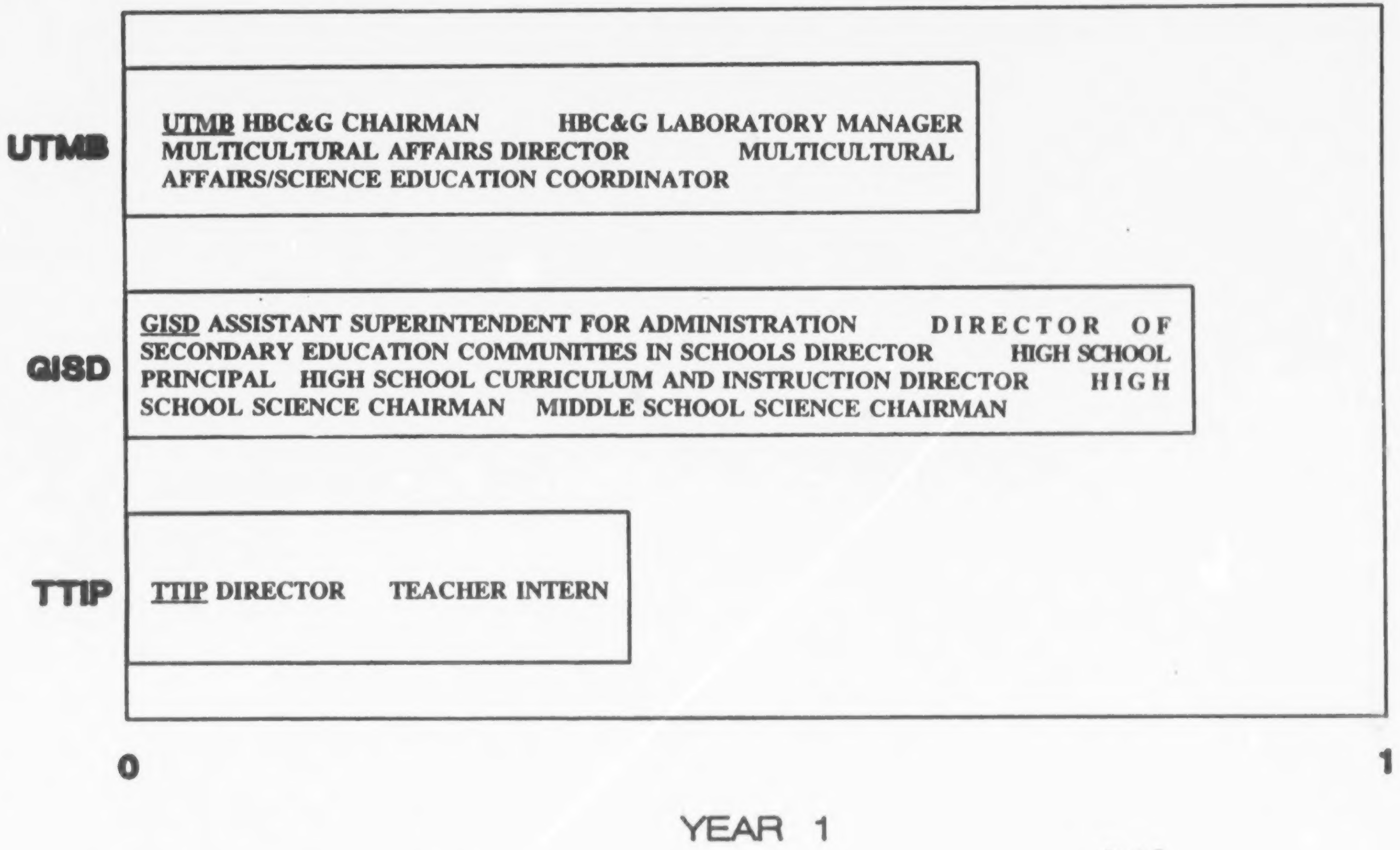
TEAMWORK

GISD/UTMB PANELISTS


BRAINSTORM
COMMUNICATE
INFORM
HBC&G STAFF
ALLIED HEALTH
PROBLEM SOLVE
GISD STUDENTS
GISD TEACHERS
SUPPORT
COLLABORATE

MENTORING

PARTICIPANTS
BRAINSTORMING COMMITTEE



UTMB

UTMB HBC&G CHAIRMAN HBC&G LABORATORY MANAGER MULTICULTURAL AFFAIRS DIRECTOR MULTICULTURAL AFFAIRS/SCIENCE EDUCATION COORDINATOR

GISD

GISD ASSISTANT SUPERINTENDENT FOR ADMINISTRATION DIRECTOR OF SECONDARY EDUCATION COMMUNITIES IN SCHOOLS DIRECTOR HIGH SCHOOL PRINCIPAL HIGH SCHOOL CURRICULUM AND INSTRUCTION DIRECTOR HIGH SCHOOL SCIENCE CHAIRMAN MIDDLE SCHOOL SCIENCE CHAIRMAN

TTIP

TTIP DIRECTOR TEACHER INTERN

356

Instruments/Equipment Used in Human Biological Chemistry & Genetics Laboratory

1. Centrifuges-low, medium, high speed
2. Computers/Calulators
3. Gene Pulser
4. Balances
5. Microwave
6. Spectrophotometer
7. Electrophotoresis equipment
8. Pipette Aid
9. Pipette-Man
10. Ph Meter
11. Liquid Scintilation Counter
12. Water Bath
13. Shakers
14. Mixers
15. Camera
16. Paper Cutter
17. Incubator Shaker
18. Gradient Maker
19. Tube Sealer
20. Micro-titer Plate Reader
21. Water Purifier
22. Cytospin Centrifuge
23. Vacuum Dryer

24. Vacuum Oven

25. Fume Hoods

26. Incubators

27. Microscopes

28. Coulter Cell Counter

29. Fax Machines

30. Biological Safety Hoods

31. Autoclave

32. Shaking Incubator

33. Freezers -20. -70. -135 degrees Celsius

RESOURCES AVAILABLE AT UTMB

UTMB STAFF COULD PROVIDE INFORMATION ON:

1. future science careers
2. preparing for different science careers
3. possible science fair projects
4. gel electrophoresis
5. sterile hood procedures
6. using a liquid handling pipette
7. gas and liquid chromatography
8. electronmicroscrophy
9. use of hemocytometer
10. cell counting systems
11. use of spectrophotometer
12. tissue culturing
13. chemical analysis
15. use of centrifuges
16. preparing buffer solutions
17. protein analysis
18. titrating buffers
19. procedures in specialized labs
20. procedures in pathology labs
21. procedures in toxicology labs
22. safety procedures in specific laboratories
23. chemical compounds used in specialized labs
24. the importance of keeping a science log book

CAREERS AT UTMB

1. Surgical Technologist
2. Microbiologist
3. Biochemist
4. Molecular Biologist
5. Physiologist
6. Dermatologist
7. Surgeon
8. Mammography Technologist
9. Medical Record Technician
10. Pharmacist
11. Social Worker
12. Medical Technologist
13. Medical Laboratory Technician
14. Electrocardiograph Technician
15. Cardiac Catherization Technician
16. Physician Assistant
17. Research Associate
18. Biomedical Equipment Technician
19. Research Review Coordinator
20. Research Assistant
21. Research Technician
22. Emergency Technician
23. Animal Attendant
24. Speech Pathologist

25. Hyperbaric Technician
26. X-Ray Technician
27. Respiratory Therapist
28. Medical Photographer
29. Clinical Specialist
30. Anesthesiologist
31. Occupational Therapist
32. Physical Therapist
33. Pediatrician
34. Psychiatrist
35. Radiologist
36. Orthopedic Surgeon
37. Ophthalmologist
38. Neurologist
39. Endocrinologist
40. Gynecologist
41. Urologist
42. Proctologist
43. Podiatrist
44. Pathologist
45. Burn Care Nurse
46. Cardiopulmonary Nurse
47. Neurological Nurse
48. Oncology Nurse
49. Renal Nurse
50. Trauma Nurse
51. Neonatal Nurse

52. Cardiologist
53. Family Medicine Physician
54. Gastroenterologist
55. Geriatrics Physician
56. Hematologist
57. Infectious Disease Physician
58. Immunologist
59. Internal Medicine Physician
60. Otolaryngologist
61. Obstetrician
62. Pulmonary Care Physician
63. Pheumatologist

MENTORING

M-merging of resources

E-exchanging information

N-new skills developed

T-training opportunities

O-our minds challenged

R-relationships established

I-increased knowledge

N-needs identified

G-growth inevitable

By: Johnetta Session

TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME:	Donald Van Alstyne
INTERNSHIP:	University of Texas Medical Branch at Galveston Marine Biomedical Institute
SCHOOL:	La Marque High School La Marque, Texas
PRIMARY SUBJECT:	Chemistry
ACTIVITIES:	• An Organic Synthesis Lab Activity • Use of the Gas Chromatograph
SUMMARY:	See attached
RESOURCES:	

TTIP
CURRICULUM IMPLEMENTATION PLAN
Abstract

NAME: Don Van Alstyne

INTERNSHIP: University of Texas Medical Branch at Galveston
Marine Biomedical Institute

SCHOOL: La Marque High School

PRIMARY
SUBJECT: Chemistry

ACTIVITIES: Teacher's Overview of Summer Research Project
Guest Speakers: Methods and Tools of Research Chemists (Dr. Charles E. Hudson)
Discussion of Mass Spectrometry (Dr. David J. McAdoo)
An Organic Synthesis Lab Activity
Use of the Gas Chromatograph

SUMMARY: The purpose of this plan is to provide enrichment activities to the students of advanced chemistry classes. The activities of the teacher's internship assignment will be shared during an overview presentation and an update will be provided during the school year as progress is made on the on-going project. The teacher's mentors have agreed to serve as guest speakers to present information on the use of mass spectrometry, gas chromatography and other tools and methods used by the research chemist. During their visits to the classroom the students will have opportunities to consider the requirements and career offerings related to chemistry as presented by these professionals. In an effort to provide the students with a related laboratory experience, similar to one of the organic synthesis preparations carried out during the teacher's summer internship, a lab activity will be conducted in the high school laboratory and then the product obtained from the student preparations will be tested for purity using the gas chromatograph in the UTMB laboratory. This final activity would include a small group of representative students and the teacher.

Name: Don Van Alstyne

School: LaMarque High School

Primary Subject: Chemistry

Internship: University of Texas Medical Branch at Galveston
Marine Biomedical Institute

Mentors: Dr. David J. McAdoo and Dr. Charles E. Hudson

OVERVIEW OF RESEARCH PROJECT

My summer research assignment for the past two summers has been with the McAcdoo lab. The principal thrust of the research that I have assisted with is an ongoing effort of this laboratory to better understand mass spectrometry. F. W. McLafferty showed that, broadly speaking, one could understand the major peaks in the mass spectra of most organic compounds in terms of their structures to the degree that it was often possible to deduce the structure of an unknown from its mass spectrum. However, many compounds exhibit peaks in their mass spectra for which no understanding exists. Before McAdoo and Hudson began work on the problem, examples of such compounds were those that showed a loss of alkanes. The molecular ions of many organic substances including ethers, ketones, and hydrocarbons have the loss of alkanes as the lowest energy fragmentation. During the 1980s McAdoo and Hudson proposed that these reactions proceeded from ion-neutral complexes. The first step of this mechanism is cleavage of one of the easily broken bonds. This step is well understood and is one of the standard mechanisms. McAdoo and Hudson suggested that, at sufficiently low energy, the radical might remain in the vicinity of the fragment ion. Even after the covalent bond has been broken, the neutral would remain attracted to the ion by ion-induced dipole forces.

The neutral resulting from simple bond cleavage of a molecular ion is a radical, and one of the well characterized reactions of radicals is hydrogen atom abstraction. If the radical abstracts a hydrogen atom from the ion, this produces an alkane. If the abstraction is an exothermic reaction, the energy liberated can drive the separation of the newly formed alkane molecule from the fragment ion. The first such reaction discovered by McAdoo and Hudson was the loss of ethane from sec butyl ether. This mechanism is illustrated on figure #1.

This summer I have been working as a part of the McAdoo team to extend this line of reasoning to alkanes. The alkyl cations, which would be involved as intermediates in the losses of small alkanes from larger alkane molecular ions, have an interesting property; they rearrange readily by hydride ion shifts. For example, the sec butyl cation has been generated in solution and in the solid phase and readily undergoes the degenerate rearrangement as illustrated in figure #2.

The energy barrier between the two resonance structures is only a few kilocalories per mole. If the ion-neutral complex idea is correct, then such rearrangements should take place in the fragmentations. We plan to detect the rearrangements using the following plan.

Butylcyclohexane (mass 140) shows the loss of butane (mass 58) in its mass spectrum. The largest peak being at mass 82. This would be the cyclohexene cation. The mass spectrum would not show a peak for the butane molecule since it is a neutral molecule. Figures #3 and #4 show the actual mass spectra for a sample of butylcyclohexane prepared by Dr. Hudson and myself in our laboratory.

Figure #5 outlines the synthesis procedures that we used to prepare the butylcyclohexane. A butyl Grignard reagent was first prepared and then reacted with cyclohexanone. These steps were carried out in a dry argon atmosphere. The intermediate product was then reacted with an aqueous hydrochloric acid solution to produce the alcohol, 1-butylcyclohexanol. At this point the aqueous layer was separated from the organic layer. The aqueous layer was extracted twice with diethyl ether. The aqueous layer was then discarded and the organic layers combined and then dried using a saturated sodium chloride solution. The aqueous layer was separated and discarded. The remaining organic layer (butylcyclohexanol/diethyl ether) was poured over #4A molecular sieves for more complete drying. Afterwards, the organic solution was subjected to the Roto-vap to evaporate most of the volume of ether. The remaining solution was then distilled at a low pressure using an aspirator, an insulated vigreux column, and a water-cooled condenser. The alcohol was then reacted with phosphorus tribromide. The 1-bromo-1-butylcyclohexane solution was then treated with ice, then with aqueous sodium carbonate, and then with saturated sodium chloride. The aqueous layer was discarded after each treatment. The organic layer was then dried over #4A molecular sieve and later the ether was evaporated using the Roto-vap. The remaining solution was distilled at a reduced pressure using a vacuum pump. The final reaction was to reduce the 1-bromo-1-butylcyclohexane to an alkane. The bromide was reacted using tributlytin hydride as the reducing agent and 1,1-azobis(cyclohexane-carbonitrile) as a free radical initiator. The excess ether was then evaporated using the Roto-vap and the remaining solution distilled at a reduced pressure using an aspirator. The product's purity was then checked on the gas chromatograph before sending the sample to the mass spectrometer laboratory.

Now consider the situation with butylcyclohexane-2,2,6,6-d4. Figure #6 illustrates the possible mechanisms for the loss of butane in the mass spectrometer. Using this deuterated form of butylcyclohexane should help to determine if rearrangements occurs. If there is no rearrangement, the molecule should show exclusive loss of C_4H_9D, as this is the only way to form the cyclohexene ion. However, if carbonium ion rearrangements do occur, then loss of C_4H_{10} is expected.

We have been working to synthesize the deuterated precursor but have experienced difficulty getting it in high isotopic purity. We have made some alterations to the procedures for preparing the undeuterated precursor such as using dichloroethane and pyridine in the solution rather than diethyl ether during the bromation reaction. We hope that this will prevent the hydrogen exchange that occurred in our first attempt at the preparation.

Similarly, low energy 5-ethylnonane ions show a peak for loss of ethane. We are also trying to prepare 5-ethylnonane-4,4,6,6-d4 with the same intent. See figure #7.

Last year Dr. Hudson and I studied a different kind of alkane loss, the loss of methane from protonated acetaldehyde. See figure #8. This is a reaction of a fragment ion with an even number of electrons. We used quantum mechanics to determine the reaction path. The acidic proton on oxygen is transferred to the methyl carbon, whereupon the molecule falls apart. Therefore the reaction is of a completely different type from the loss of alkanes from most molecular ions. The paper on this work has been accepted for publication

PREPARATION OF BUTYLCYCLOHEXANOL
A GRIGNARD REACTION

This is the preparation procedure used to produce a tertiary alcohol using a Grignard reagent. It is important that the Grignard reaction be carried out in the absence of water and oxygen. The reaction mechanism is illustrated in figure #5.

MATERIALS

1.5 grams of Mg turnings
3.6 mL of 1-bromobutane
60 mL of anhydrous diethyl ether (must be anhydrous)
lecture cylinder of argon or nitrogen gas
15 mL of 3M HCl
25 mL of saturated NH4Cl
100 mL of saturated NaCl
50 mL two-necked round bottom reaction flask
50 mL pressure equalizing dropping funnel
reflux condenser
#4A molecular sieves (10 grams)
glass wool
15 mL round bottom flask
vigreux column
condenser head
tygon tubing
aspirator
2 connectors with stopcock valves
Pasteur pipettes
125 mL separatory funnel
10 mL collection vessel and glass stopper to fit

PROCEDURE

1. Place clean two-necked round bottom flask, reflux condenser, dropping funnel and glass valve connects into a drying oven for at least 45 minutes to assure complete dryness.
2. Measure 1.5 grams of Mg turnings.
3. Assemble the warm glassware. Place the 1.5 grams of Mg turnings into the round bottom flask with a 1/2 in magnetic stirring bar. Attach the dropping funnel and reflux condenser. Attach a glass valve connector with stopcock to the reflux condenser and then a packed 10 inch tygon tube packed with 4 A sieves and cotton tips. Place a Pasteur pipette on the end of this drying tube assembly. Attach another glass connector with stopcock valve to the top of the dropping funnel and connect using tygon tubing to an Ar gas supply cylinder.

4. Open all stopcock valves and slowly purge the system of all air using a supply of Ar gas.
5. Stir the Mg turnings rapidly in the Ar atmosphere using a magnetic stirrer for at least 30 minutes.
6. Transfer 40 mL of diethyl ether to the dropping funnel and 3.6 mL of 1-bromobutane to the dropping funnel. Mix by agitation with a Pasteur pipette.
7. Slowly add the bromobutane/ether solution to the reaction flask containing the Mg turnings in the dry Ar atmosphere. Circulate water through the reflux condenser during this reaction. Continue to stir at a moderate rate during the reaction. Gently warm during the last 10ml addition of solution for reaction to complete.
8. Place a 500 mL crystallization dish or other suitable container for an ice bath around the reaction flask. Prepare an ice water bath.
9. Transfer 20 mL of diethyl ether and 3.0 mL of cyclohexanol to the dropping funnel. Agitate with a

Pasteur pipette to mix.

10. Slowly drop by drop add this solution of cyclohexanone to the reaction flask. Continue to stir during the reaction.
11. After the last addition of solution allow ten minutes for reaction to complete.
12. Add 10 mL of 3 M HCl to the reaction flask via the dropping funnel. Continue to a few more mL if excess Mg still exist.
13. Add 10 to 15 mL of saturated ammonium chloride solution to complete the neutralization.
14. Pour the contents of the reaction flask into a 125 mL separatory funnel.
15. Shake and swirl and then drain off the aqueous layer back into the reaction flask.
16. Pour for the top of the funnel the organic layer into a clean 125 mL Erlenmeyer flask.
17. Pour aqueous layer back into the separatory funnel and add 15 mL of ether to extract any remaining organic products from the aqueous layer. Shake and swirl and then drain off the aqueous layer into the reaction flask. Add the remaining organic layer to the Erlenmeyer flask. Repeat this extraction procedure again add combine all the organic layers after the second extraction back into the separatory funnel.
18. Add about 25 mL of saturated NaCl solution to the organic layer. Shake and swirl and then drain off the aqueous layer.
19. Transfer the organic layer to a clean Erlenmeyer flask.
20. Cover the flask with a Chem wipe and allow the ether to evaporate under the vent hood overnight.
21. Transfer the remaining organic solution to a clean 15 mL round bottom distillation flask. Add a small magnetic stirring bar. Connect a vigreux column and a condenser head and thermometer. Add a 10 mL receiver. Insulate the vigreux column using glass wool. Connect the head to an aspirator and start to lower the pressure using the aspirator before beginning to heat the flask.
22. After 5 minutes place a small heating mantle around the bottom to the flask and insulate with glass wool.
23. Begin heating gently. The distillate should condense at temperatures around 80 C depending on the pressure.
24. This should be the 1-butylcyclohexanol product. The sample should be stoppered and labeled.
25. A sample will be tested on the gas chromatograph in a UTMB research laboratory to check for purity.

LOSS OF ETHANE FROM ETHYL SEC-BUTYL ETHER

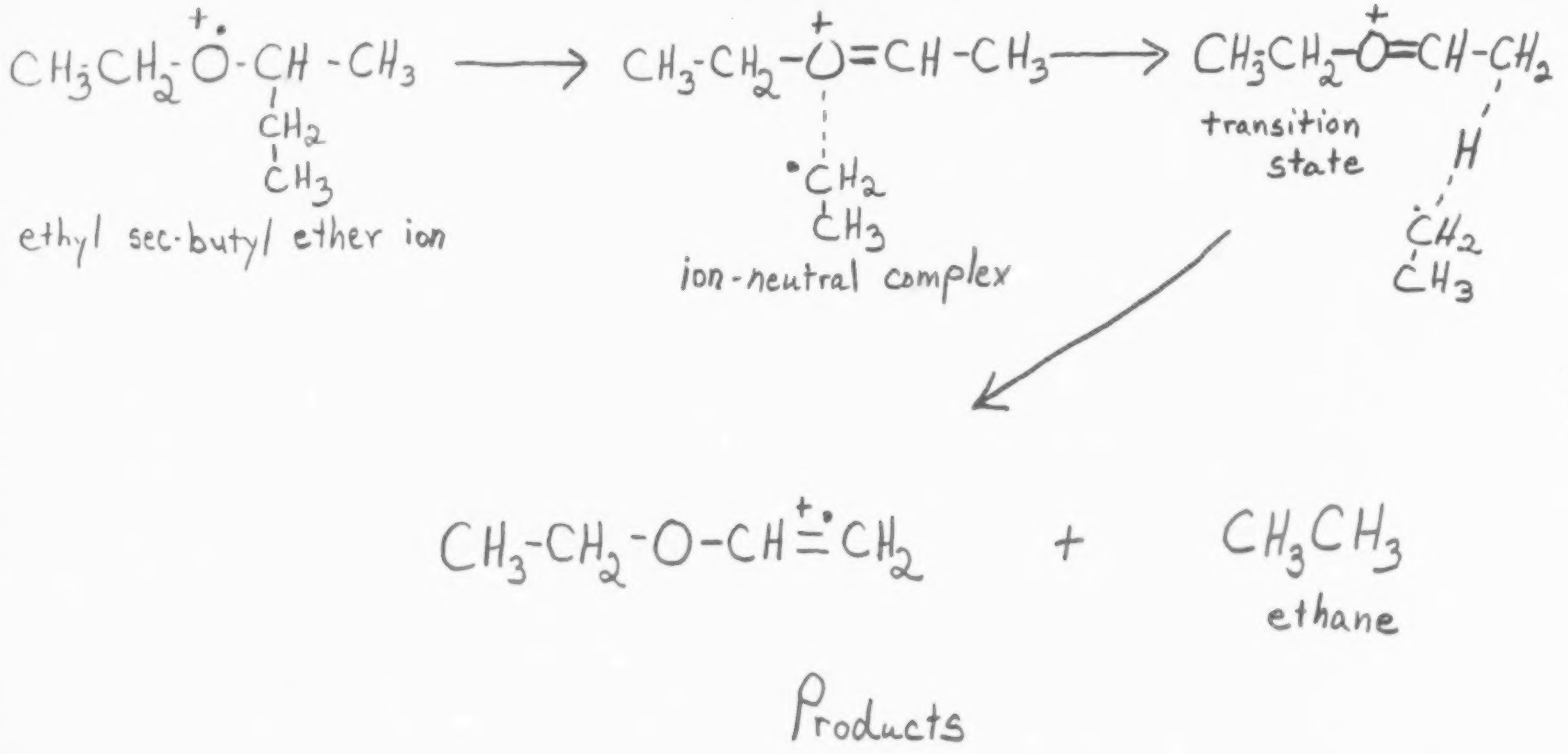

ethyl sec-butyl ether ion
ion-neutral complex
transition state
ethane
Products

figure #1

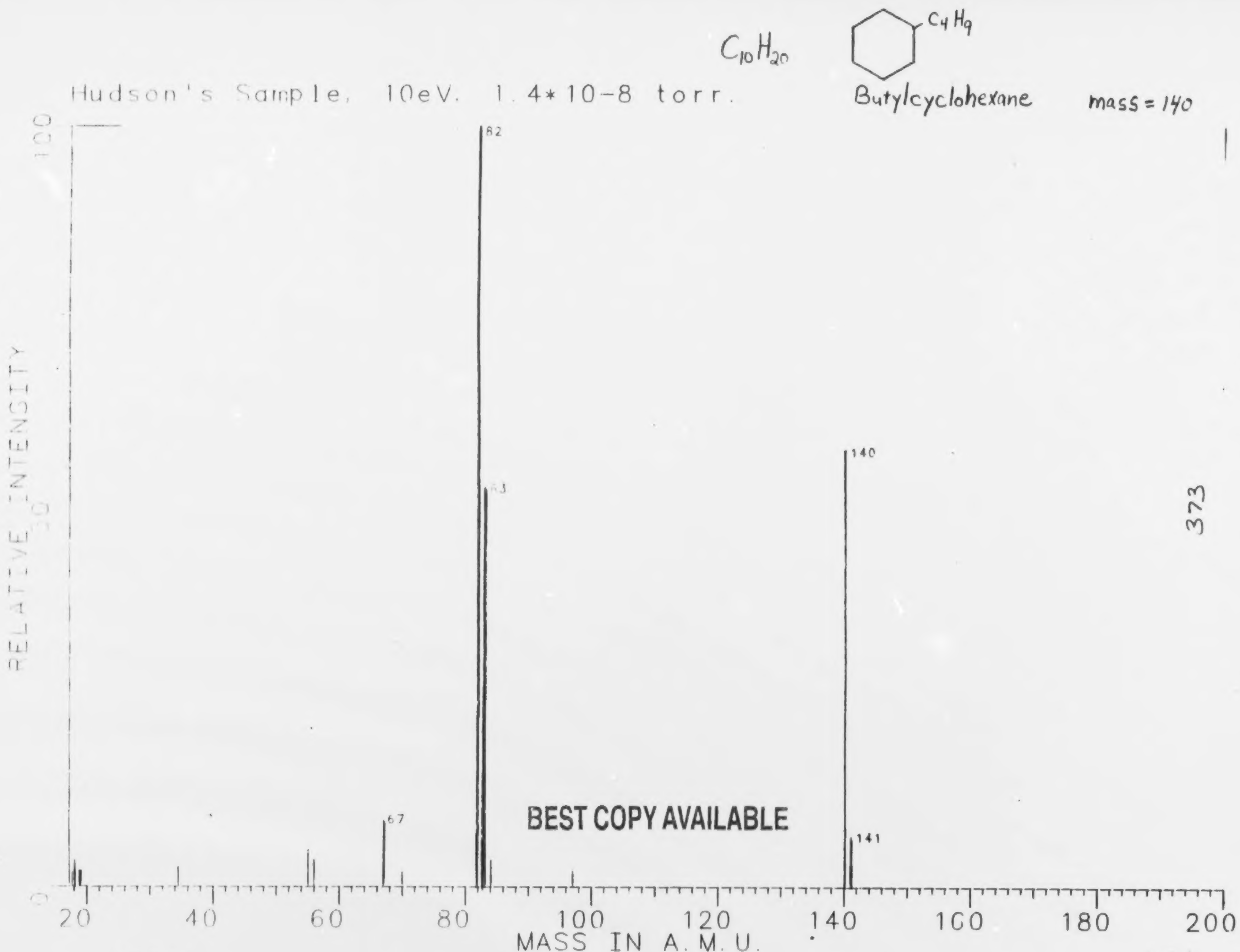
HYDRIDE ION SHIFT WITHIN AN ALKYL CATION

example: sec butyl cation rearrangement

$$CH_3-\overset{+}{C}H-CH_2-CH_3 \rightleftharpoons CH_3-CH_2-\overset{+}{C}H-CH_3$$

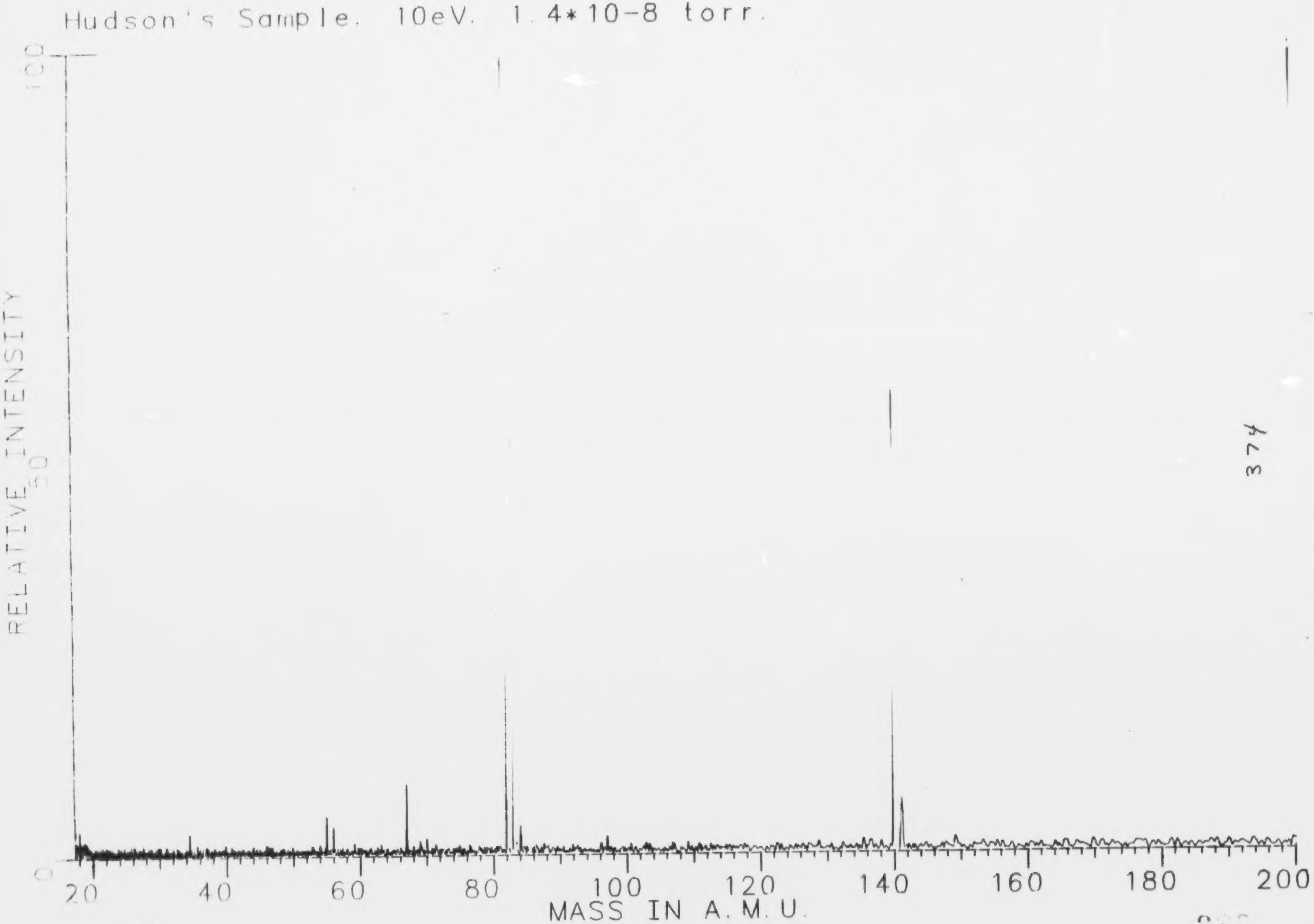
$$SbF_6^- \qquad\qquad\qquad SbF_6^-$$

figure #2.



BEST COPY AVAILABLE

figure #3

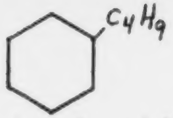

Hudson's Sample, 10eV, 1.4*10-8 torr.
RELATIVE INTENSITY
100
50
0
20
40
60
80
100
120
140
160
180
200
MASS IN A.M.U.

374

382

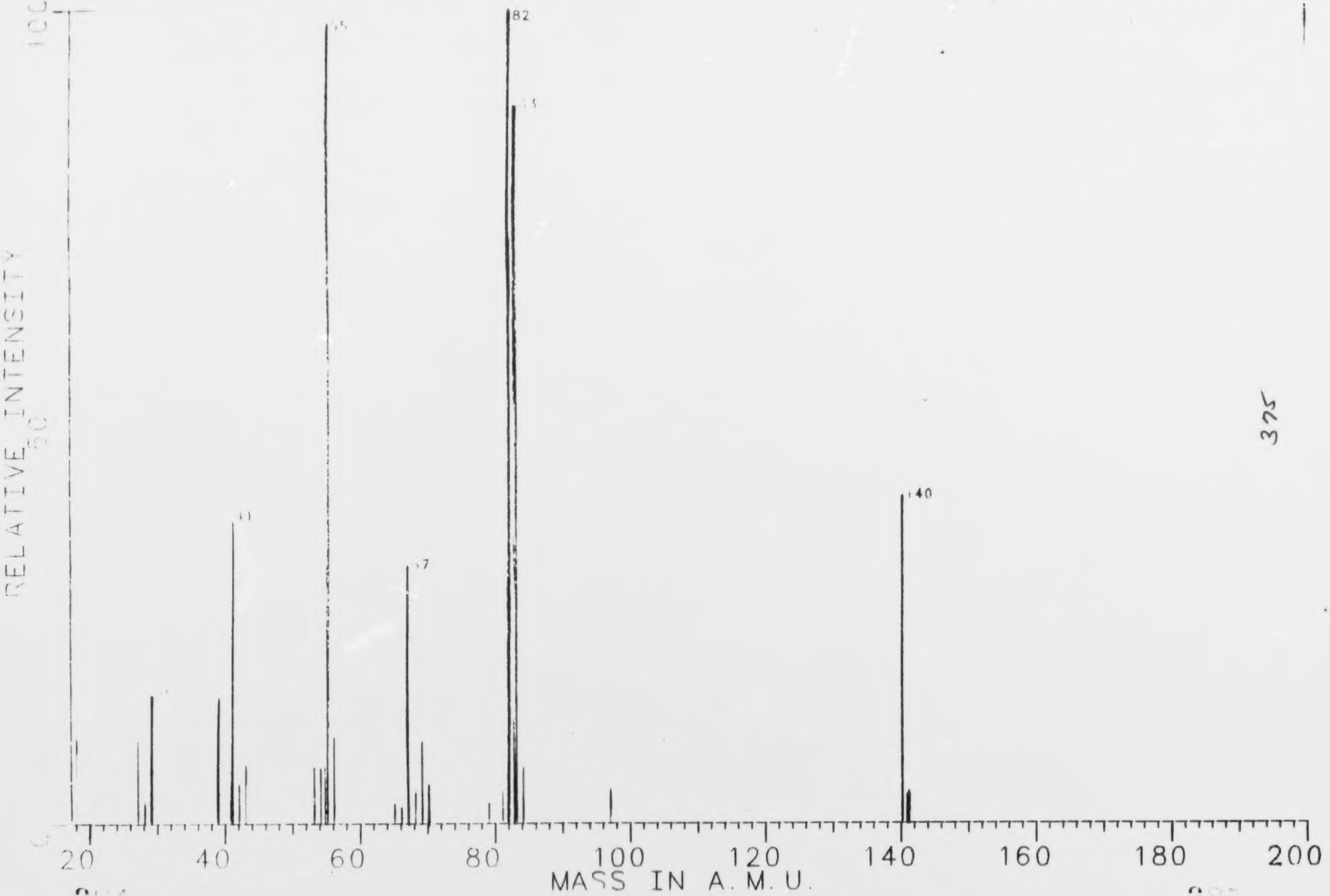
383

$C_{10}H_{20}$



Butylcyclohexane mass=140

Hudson's Sample. 50eV. 1.5*10-8 torr.

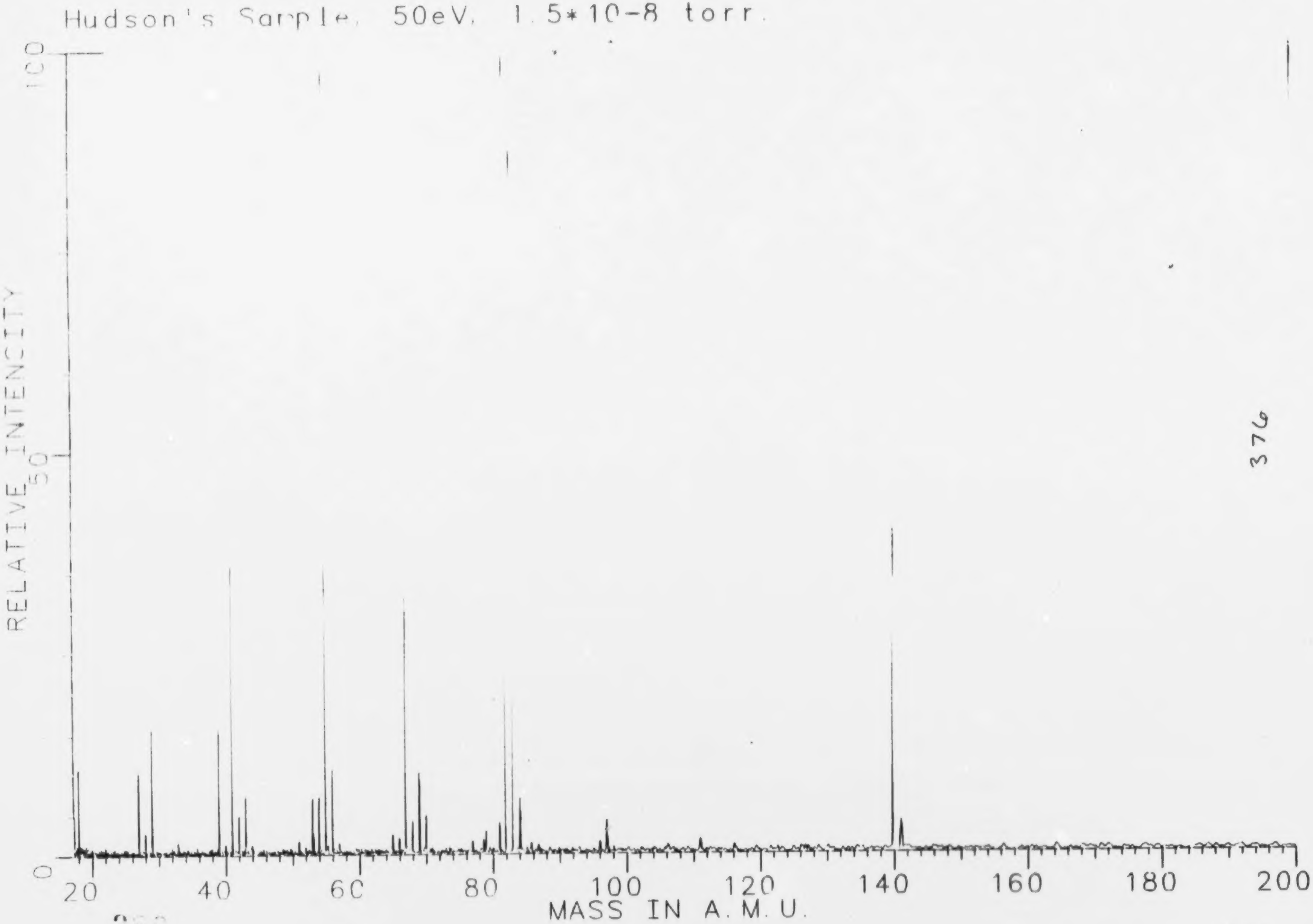


375

384

385

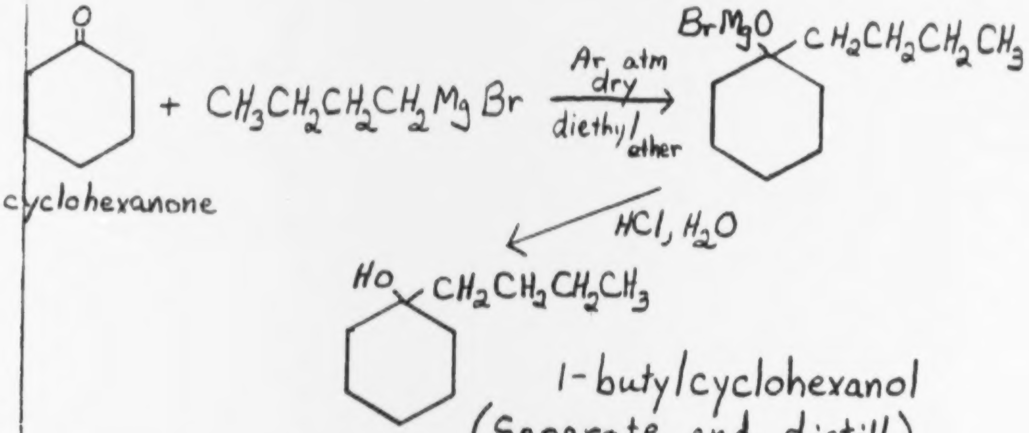
[illegible] #4


Hudson's Sample, 50eV, 1.5*10-8 torr.

Preparation of Butylcyclohexane

I. Grignard Reaction

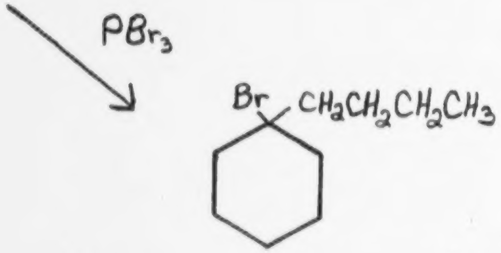
$$Mg + \underset{\text{1-bromobutane}}{CH_3CH_2CH_2CH_2Br} \xrightarrow[\text{diethyl ether solvent}]{\text{Ar atm. No water}} CH_3CH_2CH_2CH_2MgBr$$


O
+ $CH_3CH_2CH_2CH_2MgBr$
Ar atm
dry
diethyl ether
BrMgO
$CH_2CH_2CH_2CH_3$
HCl, H_2O
HO
$CH_2CH_2CH_2CH_3$

cyclohexanone

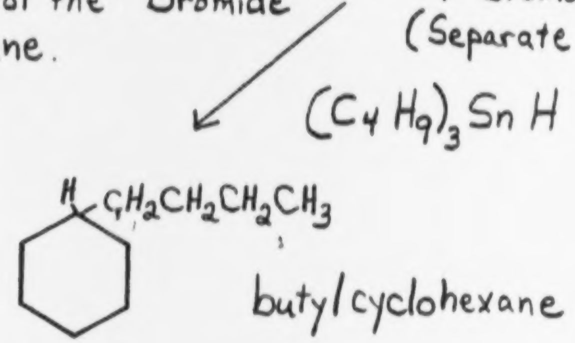
1-butylcyclohexanol
(Separate and distill.)

II Bromation of the Alcohol.


PBr_3
Br
$CH_2CH_2CH_2CH_3$

1-bromo-1-butylcyclohexane
(Separate and distill.)

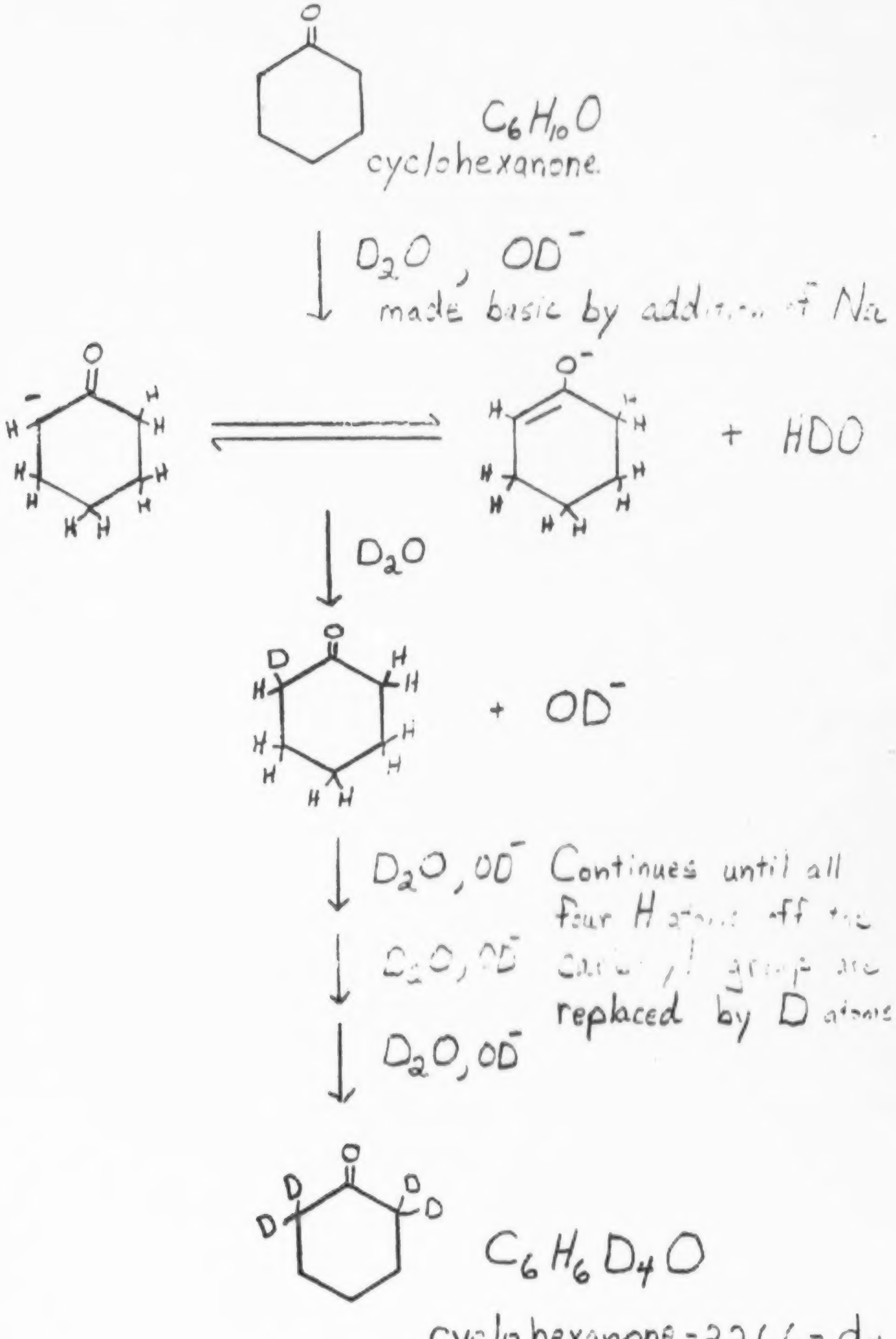
III. Reduction of the Bromide to an Alkane.


$(C_4H_9)_3SnH$
H
$CH_2CH_2CH_2CH_3$

butylcyclohexane

figure #5

Preparation of the Deuterated cyclohexanone-2,2,6,6-d_4

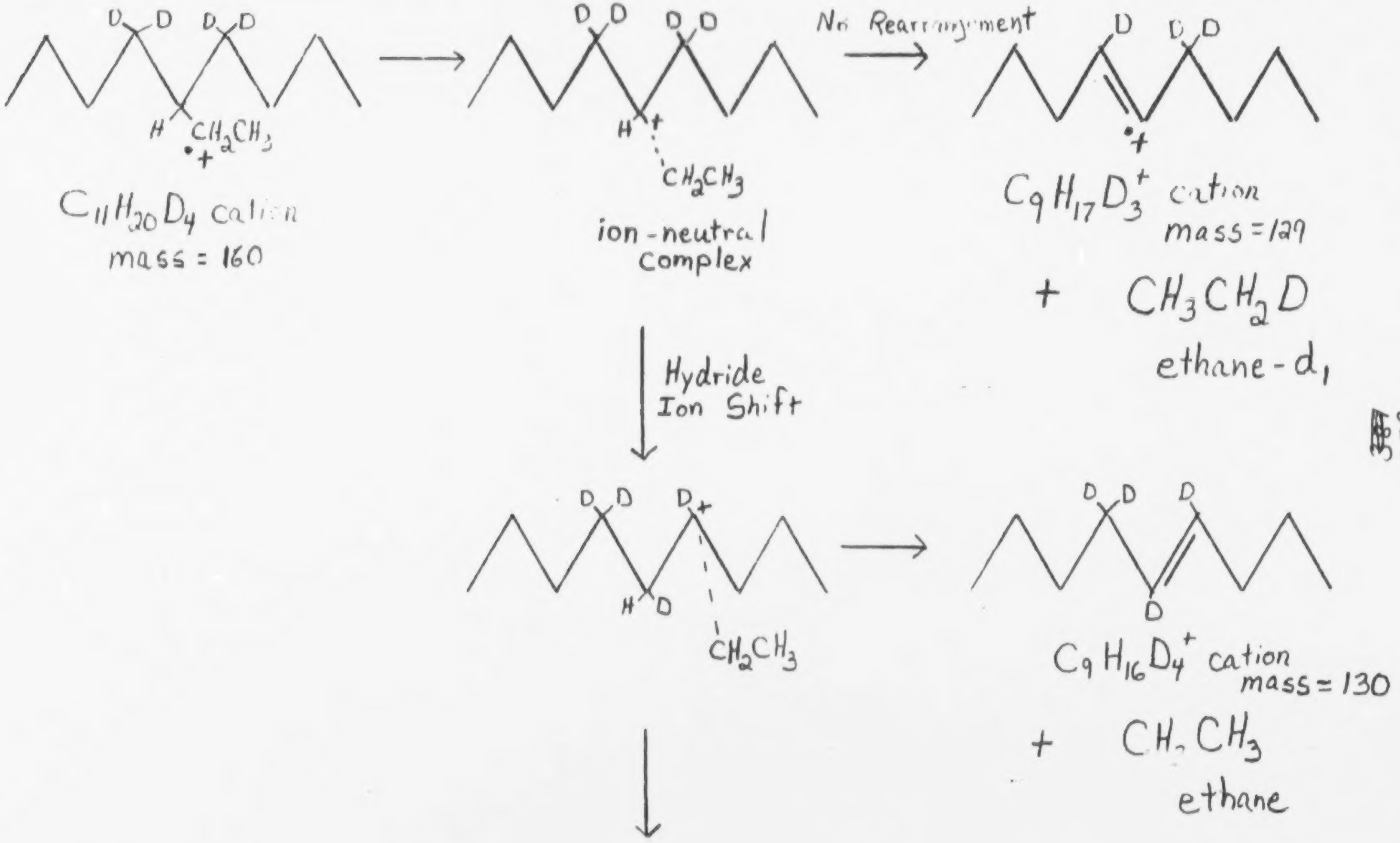

$C_6H_{10}O$
cyclohexanone.
D_2O, OD^-
+ HDO
D_2O
+ OD^-
D_2O, OD^-
D_2O, OD^-
D_2O, OD^-
$C_6H_6D_4O$
cyclohexanone-2,2,6,6-d_4

made basic by addition of Na

Continues until all four H atoms off the carbonyl group are replaced by D atoms.

figure #6

LOSS OF ETHANE FROM 5-ETHYLNONANE-4,4,6,6-d_4

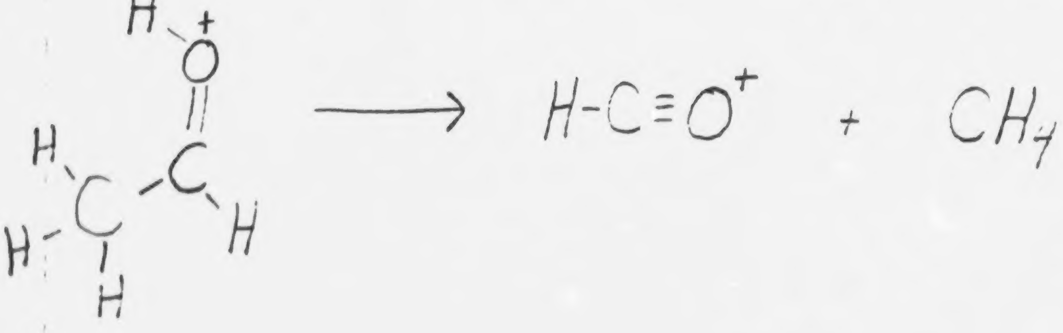


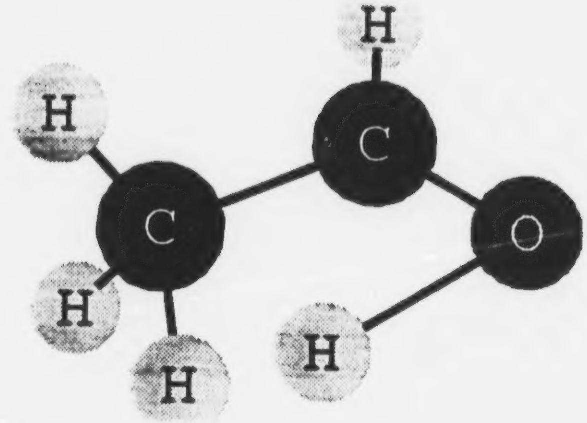
D D D D
H CH₂CH₃ •+
C₁₁H₂₀D₄ cation
mass = 160
D D D D
H +
CH₂CH₃
ion-neutral complex
No Rearrangement
D D D
•+
C₉H₁₇D₃⁺ cation
mass = 129
+ CH₃CH₂D
ethane-d₁
Hydride Ion Shift
D D D +
H D
CH₂CH₃
D D D
D
C₉H₁₆D₄⁺ cation
mass = 130
+ CH₂CH₃
ethane

Other Rearrangements also produce $C_9H_{16}D_4^+$ + CH_3CH_3.

Figure #7

Elimination of Methane from Protonated Acetaldehyde


H
O
H
C
H
C
H
H
H-C≡O+
+
CH4



transition state

figure #9

TTIP

CURRICULUM IMPLEMENTATION PLAN

ABSTRACT

NAME: Laura Anne Wolfe

INTERNSHIP: University of Texas Medical Branch
Department of Nephrology

SCHOOL: Ball High School, Galveston

PRIMARY SUBJECT: Biology I, Biology II

ACTIVITIES:

*conduct a transformation lab investigation in cooperative learning groups

*formulate conclusions from lab procedure

SUMMARY: The purpose of this CIP is to promote student interest in scientific research by providing students an opportunity to perform a bacterial transformation lab. Students will work in teams to introduce an ampicillin resistant plasmid into competent bacteria. Relevant background information is provided. Teamwork, communication, thinking, and biotechnological lab skills will be emphasized, linking student involvement to application of current research practices.

RESOURCES:

University of Texas Medical Branch
Department of Nephrology
Dr. Robert Safirstein, Director
Dr. John DiMari, Ester Tamaya,
Dr. Carl Caflisch

Carolina Biological Supply Company

BACTERIAL TRANSFORMATION LAB

Background Information: Bacterial transformation is the process by which bacteria take up extracellular DNA. This DNA can remain in the cytosol as episomal DNA or it can incorporate into the bacterial chromosome genome. If the DNA from the donor changes the phenotype of the recipient strain, then such a change can be used to select recipient bacteria that now carry the gene.

The initial experiment on transformation was performed in 1928 by English bacteriologist Frank Griffith. He experimented with two strains of bacteria called *Streptococcus pneumoniae*. One virulent strain has a polysaccharide capsule and causes pneumonia and the second does not have the capsule and does not cause pneumonia. Mice injected with the virulent bacteria died. In order to determine if a vaccination against pneumonia could be developed, mice injected with the heat-killed capsuled strain lived. However, when these dead cells were mixed with live cells from the avirulent strain and injected into mice, many of the mice died. It appeared that somehow material from the dead bacteria had entered the live cells and changed them genetically to create an encapsulated, pathogenic offspring.

Additional studies showed that bacterial transformation could be duplicated using microbiological culturing techniques. Live bacteria without capsules were inoculated into broth. Dead bacteria with capsules were then added to the broth and incubated for several hours. A drop of culture was smeared over agar in Petri dishes. A significant number of bacteria growing on the plate had capsules.

In 1944, after years of complicated studies, the research team of Oswald Avery, Maclyn McCarty and Colin MacLeod announced that the chemical responsible for transforming harmless pneumococci into virulent strains was DNA. Deoxyribonucleic acid, DNA, is the primary genetic material that encodes all of the macromolecules necessary for cell functioning. These studies have lead to the use of plasmids in research today.

Plasmids are circles of DNA found in many bacteria. Plasmids carry genes that the cell needs only under special conditions. Some plasmids code for enzymes to speed up the break down of certain sugars and others code for toxic proteins that kill other bacteria. Plasmids used in experimentation are generally 5 to 12kb in size and contain a selection marker, PCR, and ORI region. The ORI section is the origin of replication. PCR, the polycloning region, is the area where the DNA of interest is loaded using restriction endonucleases. Restriction endonucleases are proteins which cut specific sequences of DNA. The selection region contains the area of antibiotic resistance to drugs such as ampicillin, penicillin, neomycin, etc. Plasmids containing genetic sequences that confer the resistance of their host cell to antibiotics are of great medical importance. Enzymes are produced which inactivate certain drugs. This enzyme production poses a serious problem for the treatment of infectious diseases by antibiotics. Bacteria can survive because they possess these resistant conferring plasmids.

In nature, some bacteria can release their DNA into the environment which in turn can be encountered by other bacteria.

Depending on the particular species and growth conditions plasmid DNA can be picked up and recombined into the recipient's chromosome. Genes from the recombinant cell will be inherited by its descendants. Transformation works best between closely related donor and recipient cells. When a recipient cell is in a physiological state in which it can take up and incorporate the donor DNA, it is said to be competent. The permeability of the cell wall to the DNA molecule affects the competence of the cell. *Escherichia coli* is not naturally competent for transformation but can be treated under laboratory conditions to readily accept its own or foreign DNA.

The recombinant DNA-technologic revolution has evolved from this procedure. The ability to manipulate DNA and transform E. coli has pioneered experiments in genetic engineering. Genes from various organisms have been isolated. This foreign DNA is inserted into a plasmid which is then introduced into a bacterial cytosol by transformation. The bacterium can now make products of the newly acquired genes. Recombination of DNA and transformation of bacterial cells allows greater understandingof gene regulation. Bacteria can be genetically engineered to produce human substances of therapeutic importance such as insulin, growth hormones, and interferon. Surface proteins from pathogenic microorganisms can be produced in order to create vaccines. Future technical implications and benefits to mankind unfold as scientists continue to explore the boundaries of DNA research.

The following lab procedure was designed to utilize bacterial transformation as a teaching tool in the high school biology classroom.

PRELAB QUESTIONS:

1. Students should predict in which samples bacterial growth should appear prior to conducting the lab.
2. In which plates should no bacterial growth be observed? Explain your answer.

Cooperative group roles:

LEADER - only person who can ask teacher a question
reads, follows, and gives directions

MATERIAL/SAFETY PERSON - only person to leave lab table
enforces following of safety procedures
secures needed materials for group

RECORDER - records observations and conclusions from group

TRANSFORMATION LAB PROCEDURE

Students will work in groups of 6 on steps 1-6. Each student in the group will be assigned one of the six steps.

1. Transfer 0.3 ml of competent cells to transformation tubes which have been cooled on ice.
2. Add 1.5 microliters of plasmid DNA and mix gently.
3. Return to ice for 30 minutes.
4. Heat shock at 42°C for 2 minutes.
   (A heat block can be used or tubes can be immersed in a hot water bath.)
5. Quickly return tubes to ice for 2 minutes.
6. Add 1.5 ml LB broth and leave tubes overnight at room temperature

Each student will pour one plate.

7. Prepare agar plates for day 2 according to directions and available resources.

FOLLOWING DAY: Plates should be poured the day before this part. At this point students should work in groups of 3. Each student will inoculate one plate. Results will be shared within the group.

7. Within the student group of 3 people, one student will

   1) inoculate one prepoured plate of LB agar with the competent cells alone (without the DNA added)

   2) inoculate one prepoured plate of LB agar/ampicillin with the competent cells alone (without the DNA)

   3) inoculate one prepoured plate of LB agar/ampicillin with competent cells that had plasmid DNA added from steps 1-6

8. Incubate plates at 37°C overnight.

9. Observe growth patterns the following day and answer postlab questions.

10. To add another dimension to the transformation lab, students could work in groups of 4. The transformation could be performed with 2 samples: one containing the plasmid DNA from day 1, the other water. Students would have to design an experiment in order to determine which sample contained the plasmid DNA. The procedure would be similar to step 7 but would include a fourth plate.

    4) inoculate one prepoured plate of agar/ampicillin with the unknown substance

POSTLAB EVALUATION:

1. Were your prelab predictions confirmed?

2. In which plates did bacterial colonies appear?

3. If two unknown samples were used, which samples contained the transformed competent bacteria?

4. What observations lead you to your conclusions?

GOING FURTHER:

Describe additional experimentation or application of bacterial transformation.

PREPARING PLATES:

Options: I would recommend the option that promotes maximum student involvement, however, options are limited to available resources.

1) L.B. medium
   10 g tryptone
   5 g yeast extract powder
   10 g NaCl
   add distilled water to 1 liter
   adjust pH to 7.2 using 1N NaOH

   L.B. agar : mix L.B. medium with 15g agar per liter
   Autoclave for 20 minutes.

   Pour plates. (1 L = 25 plates)

**** To prepare L.B. agar with ampicillin add 25 mg of ampicillin/L when broth temperature is below 60°C

2) L.B. Broth Agar Base
   Suspend 45 g in 1 liter distilled water.
   Autoclave and pour.

3) L.B. Broth Agar
   Melt in microwave oven, water bath or autoclave, cool.
   Pour into sterile plates.

4) L. B. Agar
   purchase prepoured plates in sets of 10.

The option I have used for other labs is #3. Each student in their lab groups pours an individual plate after heating agar in a hot water bath.

Competent E. coli

Options:

1) if equipment is available, follow laboratory procedures given to make E. coli competent for transformation.

2) competent E. coli and plasmid DNA (pAMP) can be ordered from Carolina Biological Supply Company

PROCEDURE:
Creating competent cells (*):

1. Inoculate a tiny bit (3 microliters) of *E. coli* (JM101, NM522) into a 5 ml LB (luria broth) and shake overnight at 37°C.

2. Inoculate 80 ml LB in a 250 ml sidearm flask with 4 ml of the E. coli overnight culture.

3. Shake the 250 ml sidearm flask at 37°C for about 1 hour or 1 1/2 hours at speed 6.

4. Transfer 80ml to an SS34 screw cap tube (holds 50 ml so divide sample into 40ml each) and spin down at 1000 rpm for 5 minutes or 2500 rpm for 2 minutes depending upon available centrifuge speed.

5. Pour off supernatant.

6. Resuspend cells in 40 ml of ice cold 50 mM $CaCl_2$ (**) by pipetting gently up and down. Let sit on ice for 20 minutes.

7. Spin down cells at 1000 rpm for 5 minutes or 2500 rpm for 2 minutes depending upon available centrifuge speed.

8. Gently resuspend in 8 ml ice cold 50 mM $CaCl_2$. Keep on ice for 2 hours or longer.

* If materials are unavailable to create competent cells, they can be ordered from Carolina Biological Company.

**To prepare 50 mM of $CaCl_2$, mix 5.55 g of $CaCl_2$ per liter of distilled water.

REFERENCES:

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RESOURCES:

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APPENDICES

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TEXAS TEACHER INTERNSHIP PROGRAM

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TEXAS TEACHER INTERNSHIP PROGRAM
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TEXAS TEACHER INTERNSHIP PROGRAM
Teacher Intern Pre-Questionnaire

Sex: M - 7
F - 13

Ethnic Background:
Black - 3
Hispanic - 1
Asian - 0
White - 16

Scale: 1 = No, not at all. 5 = Yes, definitely.

	1	2	3	4	5
1. I believe it is important for my students to:					
a. Work in groups	5%		5%	35%	55%
b. Complete joint or group projects		10%	5%	40%	45%
c. Give oral reports or presentations			30%	35%	35%
d. Submit formal written reports		10%	15%	30%	45%
e. Do special projects or assignments on current issues or new developments in math, science or computer science	5%		20%	20%	55%
2. In my lesson or discussions, I believe it is important to refer to:					
a. New developments in subject areas	5%		5%	15%	75%
b. Current research in subject area	5%		5%	21%	69%
c. State-of-the-art techniques in subject area	5%	5%	5%	16%	69%
3. I believe it is important to integrate science, mathematics and technology in the classroom.	5%		10%	5%	80%
4. I believe it is important to provide my students with information about careers in math, science or computer science.	5%		5%	25%	65%
5. I believe that I am keeping current on:					
a. careers in math, science or computer science	15%	5%	30%	30%	20%
b. technological advances	5%	10%	45%	25%	15%
c. the realities of the workforce	10%	5%	45%	40%	
d. the advances in research	5%	11%	53%	20%	11%
6. I feel comfortable counseling students in possible careers in math, science or computer science fields.	5%	10%	30%	35%	20%

	1	2	3	4	5
7. I believe it is important to stress problem solving and higher order thinking skills of my students.	5%			20%	75%
8. I believe it is important to utilize computers and other technologies in the classroom.	5%		10%	20%	65%
9. I am enthusiastic about teaching.	5%		5%	10%	80%
10. I believe that collaboration with industry professionals during the school year will enrich my classroom teaching.	5%		5%	10%	80%
11. I intend to continue a working relationship with my mentor during the school year.			15%	10%	75%
12. I believe that definite improvements in education will result from the collaboration of teachers and professional experts.		5%		20%	75%

TEXAS TEACHER INTERNSHIP PROGRAM
Summer 1994 Teacher Evaluations

1. Please rate the values of your internship experience compared to other professional development experiences you have had.
Scale: 1 = low/poor . . . 5 = outstanding/excellence

1	2	3	4	5	6
		6%	12%	77%	6%

2. The best thing about my summer internship was ...

- increased knowledge.
- been able to see first hand the willingness of industry & state agencies to help the teaching professional.
- getting paid to learn and work with professionals.
- the hands-on experience of using advanced technology and being able to relate it to the world and its problems.
- the professional contacts I have made at the state level.
- learning real use and limitations of analytic instrumentation.
- knowing I had the experience of my mentor available at anytime and their willingness to provide assistance.
- getting involved with program development with wonderful people.
- extracting DNA and running gels so that I can prepare a lesson to show the students.
- learned that there is a lot of science I do not know nor completely understand.
- increasing our access to the Information Superhighway.
- learning about the field and the people I got to meet.
- the feeling that I was contributing to the team.
- the opportunity to develop rapport with local research facility.
- seeing research going on everywhere on every conceivable topic.
- the exposure to the latest technology and new applications.

3. The worst thing about my summer internship was ...

- not having enough time with the technician.
- a short span of time in which to accomplish a great deal.
- my mentor assigned be to a graduate student who never comes to work.
- trying to write a CIP that relates directly to my research assignment.
- lack of facilities & materials at school.
- stress to produce what my vision or my mentor's vision was.
- it all went by too fast.
- giving up my summer vacation time.
- did not have enough time to complete all that I wanted to.
- limited space & equipment at the site.
- some projects not well defined.
- my mentor did not show much interest.
- the feeling of helplessness.
- it is going to end.

4. The most important thing that I have gained from my internship experience was..

- increased knowledge.
- the desire to seek out funding to purchase biological equipment that we really need, without depending on the school administration (I know what to buy, and how to use it).
- how industry operates and what kinds of education is needed to function in industry.
- finding ways to integrate this new information into my research & teaching.
- a network of friends who are excellent sources of career modeling for students.
- learning about group work in the working world.
- networking with a number of other professionals in government agencies.
- working with competent individuals who respected my opinion and allowed my creativity to flow.
- re-emphasizing how important education is to succeed in the job market today.
- learning how to network and communicate with people on all levels in various departments.
- a greater understanding of how scientists do basic research in lab settings and being able to take this back to my classroom.
- I have materials I know my kids need.
- exercising higher order thinking skills on work not related to education.
- it kept the old brain stimulated!
- it charged my battery scientifically and elevates my enthusiasm.

Scale: Job Assignment	Teacher/mentor relationship
1-Not beneficial	1-Non existent
2-Rarely beneficial	2-Barely existent
3-Beneficial	3-Sometimes good
4-Very beneficial	4-Good most of the time
5-Extremely beneficial	5-Consistently good

5. My job assignment was:

Clearly defined	1	2	3	4	5
	5%		20%	25%	50%
Appropriate for my background	1	2	3	4	5
			5%	10%	85%
Mentally stimulating/challenging	1	2	3	4	5
			5%	10%	85%

6. My mentor was:

Prepared for my arrival	1	2	3	4	5
	5%			30%	65%
Knowledgeable about the program	1	2	3	4	5
	5%		10%	45%	40%
Supportive of my effort/work	1	2	3	4	5
	5%		5%	5%	85%
Supportive of my curriculum plan	1	2	3	4	5
	5%		5%	20%	70%
Helpful in my new environment	1	2	3	4	5
	5%		10%	20%	65%

7. Overall, my mentor/teacher relationship was:

Professionally fulfilling	1	2	3	4	5
			15%	10%	75%
Effective for my growth	1	2	3	4	5
			10%	10%	80%
Contributed to the attaining of my goals	1	2	3	4	5
			10%	15%	75%

General comments about your mentor/teacher relationship ...

- my mentor was readily available to answer questions.
- my mentor was more of a facilitator that worked out very well.
- we have become friends professionally.
- they always found time to answer my questions.
- I plan on using my mentor for years to come.
- the relationship has been very beneficial & rewarding.
- I feel that I can go to them at any time for help during the year.
- the relationship was ideal because it allowed for personal growth and creativity.
- my mentor is looking forward to helping me throughout the coming year.

Rate each of the following based on its relevance to your internship experience.
Scale: 1-Not relevant at all
2-Slightly relevant
3-Moderately relevant
4-Relevant
5-Very relevant

8. Increased self-confidence	1	2	3	4	5
			10%	50%	40%
9. Personal revitalization	1	2	3	4	5
		5%	5%	35%	55%
10. Renewed enthusiasm for teaching	1	2	3	4	5
	5%		20%	45%	30%
11. Increased subject knowledge	1	2	3	4	5
		5%	10%	15%	70%
12. Increase practical applications	1	2	3	4	5
			5%	20%	75%
13. Increased knowledge of related subjects	1	2	3	4	5
			10%	40%	50%
14. New perspectives on your subject area	1	2	3	4	5
			10%	35%	55%
15. Increased knowledge of careers	1	2	3	4	5
			5%	35%	60%
16. Increased knowledge of workplace skills	1	2	3	4	5
			5%	40%	55%

Based on your internship experience, rate the likelihood of translating the following activities to your students.

Scale: 1-Not likely at all
2-Somewhat likely
3-Probably likely
4-Very likely
5-Definitely likely

17. Addition of new content to lesson labs	1	2	3 5%	4 37%	5 58%
18. Revision of content within existing lessons	1	2 16%	3 5%	4 37%	5 42%
19. Examples and applications from internship	1	2 5%	3	4 58%	5 37%
20. Lessons on careers/educational requirements	1	2 11%	3 16%	4 32%	5 41%
21. Visits from your mentor to your school	1	2	3 16%	4 26%	5 58%
22. Opportunities for interaction	1	2	3 11%	4 37%	5 52%
23. Using materials and equipment from site	1	2 11%	3 11%	4 20%	5 58%
24. Sharing materials and resources with others	1	2 5%	3 5%	4 32%	5 58%
25. Sharing experience with community	1	2 5%	3 5%	4 16%	5 74%
26. Projects based on "real-world" problems	1	2	3 11%	4 17%	5 72%
27. Having students working in groups	1	2	3	4 44%	5 56%
28. Requiring students to complete group work	1	2	3	4 44%	5 56%
29. Requiring oral and group presentations	1	2	3 17%	4 33%	5 50%
30. Requiring formal written reports	1	2 11%	3 17%	4 39%	5 33%
31. Integrating math, science, and technology	1	2 6%	3	4 22%	5 72%
32. Integrating other subject areas	1	2	3 11%	4 67%	5 22%
33. Introducing new technology	1	2 6%	3 6%	4 28%	5 60%
34. Using computer applications	1	2 6%	3 11%	4 28%	5 55%
35. Emphasizing good work habits	1	2 6%	3 11%	4 33%	5 50%
36. Emphasizing laboratory safety	1	2 6%	3 18%	4 24%	5 52%

Comments/Suggestions:

- rewarding experience that enhanced techniques, my teaching and skills.
- wish I could participate every year.
- wish everyone could have the joy of this experience.
- the Texas A&M staff was very supportive and this is an excellent program.
- to bad that Texas A&M started this program instead of UT.
- I enjoyed the program and I feel that my students will benefit greatly from my experience.

- more coordination between the mentor and the Alliance.
- information concerning projects should be given to interns beforehand, so they are aware of research that is in process.

TEXAS TEACHER INTERNSHIP PROGRAM
Mentor/Coordinator Pre-Questionnaire

Sex:	M - 8	Ethnic Background:	Black	-	1
	F - 8		Hispanic	-	
			Asian	-	
			White	-	14

Scale: 1 = No, not at all. 5 = Yes, definitely.

1. I believe it is important for teacher to require students to:

a. Work in groups	1	2	3	4	5
			19%	19%	62%
b. Complete joint or group projects	1	2	3	4	5
			13%	19%	68%
c. Give oral reports or presentations	1	2	3	4	5
		6%	13%	19%	62%
d. Submit formal written reports	1	2	3	4	5
			19%	25%	56%
e. Do special projects or assignments on current issues or new developments in math, science or computer science	1	2	3	4	5
			19%	25%	56%

- Flexibility is extremely important to offer choices and options that employ a variety of learning styles

2. I believe teachers' instruction should include information on:

a. New developments in subject areas	1	2	3	4	5
			6%	50%	44%
b. Current research in subject area	1	2	3	4	5
		13%	6%	31%	50%
c. State-of-the-art techniques in subject area	1	2	3	4	5
		6%	19%	37%	38%

- Concepts are more important than details

3. I believe it is important for teachers to facilitate the integration of science, mathematics and technology in the classroom.

	1	2	3	4	5
				6%	94%

- technology is a "tool" with which you can learn, mathematics is also a "tool". All these together are important. Equally important is to integrate the "hard courses" into the "softer" subjects.
- Use of technology to demonstrate science is important. Students must understand (not memorize) the basic science.

4. I believe it is important for teachers to provide information about career options in math, science or computer science.

	1	2	3	4	5
			13%	31%	56%

- From a wide range of jobs that require a wide range of skill levels and preparation.

5. I believe that teachers are keeping current on:

	1	2	3	4	5
a. careers in math, science or computer science	6%	25%	50%	19%	
b. technological advances	6%	25%	50%	19%	
c. the realities of the workforce	13%	31%	43%	13%	
d. the advances in research	13%	13%	61%	13%	

	1	2	3	4	5
6. I believe teachers should stress students' development/use of problem solving and higher order thinking skills in the classroom.				19%	81%
7. I believe it is important to utilize computers and other technologies in the classroom.			13%	25%	62%
8. It is my present understanding that teachers are maximizing the use of available resources in the classroom.	6%	13%	31%	31%	19%

- The little resources available to them.
- Lack of awareness of resources or strategies for acquiring them.
- Teachers' own limitations and fears may also limit them.

	1	2	3	4	5
9. I believe I have a clear understanding of the challenges teachers face today.		31%	19%	37%	13%

- Teachers have a tough job trying to be educators as well as role models.

10. I believe my teacher intern will return to the classroom with:

	1	2	3	4	5
a. an increased knowledge of their content area.			6%	50%	44%
b. an increased confidence in presenting current information to students and colleagues.			6%	50%	44%
c. information concerning career opportunities/educational requirements that will assist in counseling students on careers in math, science, and/or computer science fields.				50%	50%
d. resources to enhance classroom instruction				44%	56%

	1	2	3	4	5
11. I intend to continue a working relationship with my teacher intern, providing support, as necessary, during the school year.				38%	62%
12. I believe that definite improvements in education will result from the collaboration of teachers and professional experts.					100%

TEXAS TEACHER INTERNSHIP PROGRAM
Summer 1994 Mentor Program Evaluation

List at least two things that you and/or your department gained by hosting a teacher intern this summer.

- learning to convey the very fundamentals of research to a novice.
- develop a simple but effective research problems.
- direct feedback of the role of a scientist in public education.
- the teacher position provided us with the option to investigate new areas.
- design & development of an important research instrument calibration device that would not have been accomplished without the teacher's participation.
- unique insight into education that will assist in the improvement of our own education program to teach residents in the fundamentals of biomechanics.
- skilled person to help with ongoing research.
- interactive, effective communicator helpful in day-to-day activities.
- helped us with techniques in training.
- accomplishment of projects which would otherwise go undone.
- establishment of contact with schools for academic activities.
- made valuable connections with the potential to set up some collaborations for improving science teaching.
- a good solid worker who brought creativity to our approaches.
- terrific stimulation of new ideas and motivation for other staff members to work.
- lots of input from a teachers point of view about young people of different ages.
- new contacts with other teachers and continued involvement of intern after program ends.
- expertise and insights that only an experienced teacher could provide.
- a completed educational product that we could not have done nearly as well without teacher input and know-how.
- friendship.

Describe the development of the teacher's position.

- series of discussions.
- series of technical instructions
- frequent reviews.
- pose a hypothesis and design experiments to test it.
- setting up of a question to have the intern research.
- individual participation in an ongoing research project, gradually assuming more responsibility as technical understanding and lab skills developed.
- outlined a series of projects and then narrowed them down based on what the intern was interested in.
- a draft job description was developed prior to the intern's arrival.
- we set out a plan of action to produce a product/material ideas that we wanted to produce for use in classrooms and to have available for kids.

Did the teacher fit into the natural flow of production/work in your facility?

Yes 100% No

Please describe any transition problems that occurred during the internship.

- the mentor needs to be more prepared for the intern.
- it would be nice to know what the intern would like to gain from the program.
- anxiety about whether the intern was up to the task.
- learning curve on new techniques.
- not having program information being passed on to us on our end.
- staff needs to be better prepared for the intern.

Were you involved in the interview/selection of the teacher intern?

Yes 54% No 46%

If yes, what was your involvement and how would you change this in the future.

- selected from applications and interviews.
- visited with intern prior to coming into the lab.

Comments/Suggestions:

- having an educator to help us was a great advantage.
- appreciated opportunity to participate!
- it was good for the teacher was well as the lab.

- work out contractual issue early.
- previous enrollees should be recruiting people of the program and bringing them to prospective mentors.
- have interns return for a second summer to build on what they learned.

TEXAS TEACHER INTERNSHIP PROGRAM
Orientation Session Evaluation

Scale: 1 No, not at all — **Teacher**
5 Yes, Definitely — Mentor

This meeting clarified my understanding of the internship program.

1	2	3	4	5
			29%	**71%**
	8%		42%	50%

I now understand my role in the internship program.

1	2	3	4	5
			21%	**79%**
			25%	75%

I think that the orientation session is held at an appropriate time in the program.

1	2	3	4	5
			24%	**76%**
			36%	64%

Providing an opportunity for networking was a positive factor in the meeting.

1	2	3	4	5
			42%	**58%**
		8%	25%	67%

The meeting was well organized.

1	2	3	4	5
			23%	**77%**
			58%	42%

The presenter(s) were knowledgeable about the program and communicated effectively.

1	2	3	4	5
		5%	**24%**	**71%**
			67%	33%

In the future, the orientation session should be held for:

teacher interns only	**55%**	92%
teachers and mentors in separate sessions	**5%**	
teachers and mentors together	**40%**	8%

In the future, the orientation session should be:

a two hour meeting	**85%**	83%
a half-day meeting	**15%**	17%
a full-day meeting		

COMMENTS:

- **Great program. Opportunity to publish and obtain graduate credit is a great part.**
- **Schedule later start time for traffic.**
- **Start together but split later.**

- Worthwhile & well presented.